

IT COVER

JUL 28 1943

# Electrical Contracting



JULY, 1943



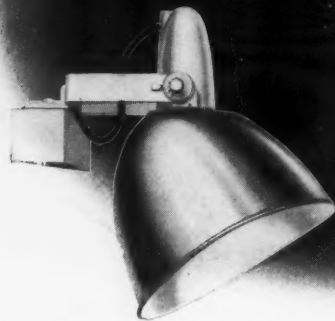
BUY WAR BONDS  
AND STAMPS  
FOR VICTORY

# NEED FLOODLIGHTS IN A HURRY?

HERE THEY ARE—

DELIVERY

IN 2 WEEKS\*



## Type L-45—300-1500 watts

Sturdy and inexpensive, this all-purpose floodlight offers an easy, simple method of effective outdoor floodlighting for either temporary or permanent installation. It is light, strong, and flexible, and will stand up under the rough handling and constant change of location often necessary for such applications as lighting for construction work at night.

The L-45 provides a wide-angle light for illuminating large ground areas, and is usually mounted on poles within or near the area to be lighted. For longer range, or emphasis on certain objects, auxiliary internal reflectors are available.

The main reflector is die-formed steel, porcelain-enamel finished inside and out. The outer surface is dark green, the inner reflecting surface, a double coat of white. It is available with four types of mountings: crossarm bracket, oval base, pipe clamp, or pipe slip-fitter.

## Type L-68—1500 watts

Designed for long service with minimum attention, the strong construction and high efficiency of this floodlight over long periods of time make it ideal for permanent installations. For durability and strength this floodlight has a steel housing with an inner silvered-glass reflector—one of the best commercial light-reflecting surfaces available.

Optional, steel reflectors are available for either narrow- or wide-beam light distribution. An asbestos gasket between reflector and housing makes the floodlight completely weatherproof. All iron and steel parts have a rust-resistant finish, and an external coat of dark-green paint.

The cover glass is clear, convex, heat-resistant Pyrex, 18 inches in diameter. A number of mountings are available: crossarm, oval base, pipe slip-fitter, pipe clamp, or pipe top.

Type of Mounting	Open Type		
	Without Auxiliary Reflector	With Diffuse Auxiliary Reflector	With Polished Auxiliary Reflector
	Cat. No.	Cat. No.	Cat. No.
Crossarm bracket	A41G13	A41G23	A41G33
Oval base	A41G12	A41G22	A41G32
1—2-in. pipe clamp	A41G17	A41G27	A41G37
1½-in. pipe slip fitter	A41G14	A41G24	A41G34
2-in. pipe slip fitter	A41G15	A41G25	A41G35

Resetting rings are available for vertical and horizontal repositioning.

TYPE L-45  
300 to 1500 watts

TYPE L-68  
1500 watts

### WHERE TO ORDER:

Place your order with the nearest G-E floodlight distributor, the nearest G-E office, or send it direct to General Electric, Schenectady, N. Y.

Type of Mounting	Open Type				Enclosed with Plain, Clear Door Glass				Enclosed with Plain, Clear Door Glass and Internal Glass Reflector			
	Narrow Beam		Wide Beam		Narrow Beam		Wide Beam		Narrow Beam		Wide Beam	
	Cat. No.	Cat. No.	Net	Ship.	Cat. No.	Cat. No.	Net	Ship.	Cat. No.	Cat. No.	Net	Ship.
Oval base	A52G72	A52G82	12	43	A52G42	A52G52	17	48	A52G62	A52G72	27	58
Crossarm	A52G73	A52G83	10	41	A52G43	A52G53	15	46	A52G63	A52G73	25	56
Slip fitter, 1½ in.	A52G74	A52G84	16	47	A52G44	A52G54	21	52	A52G64	A52G74	31	62
Slip fitter, 2 in.	A52G75	A52G85	16	47	A52G45	A52G55	21	52	A52G65	A52G75	31	62
Slip fitter, 2½ in.	A52G76	A52G86	16	47	A52G46	A52G56	21	52	A52G66	A52G76	31	62
Pipe clamp, 1-2 in.	A52G77	A52G87	14	45	A52G47	A52G57	19	50	A52G67	A52G77	29	60
Pipe clamp, 2½-3½ in.	A52G78	A52G88	14	45	A52G48	A52G58	19	50	A52G68	A52G78	29	60
Pipe top, 1½-2 in.	A52G75	A52G85	13	44	A52G49	A52G59	18	49	A52G69	A52G79	28	59
Pipe top, 2½ in.	A52G80	A52G90	13	44	A52G50	A52G60	18	49	A52G70	A52G80	28	59

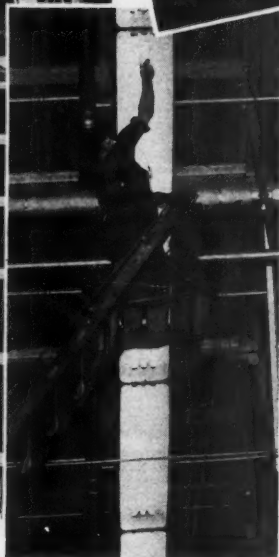
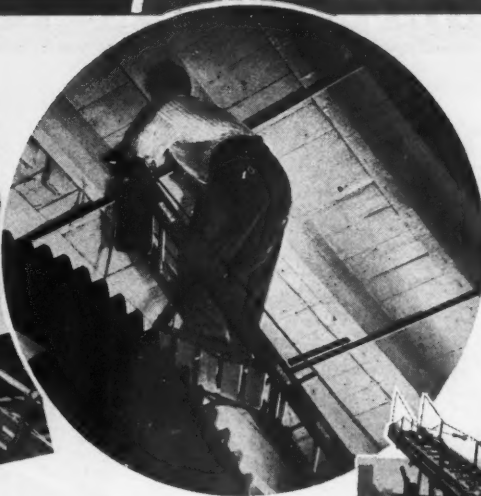
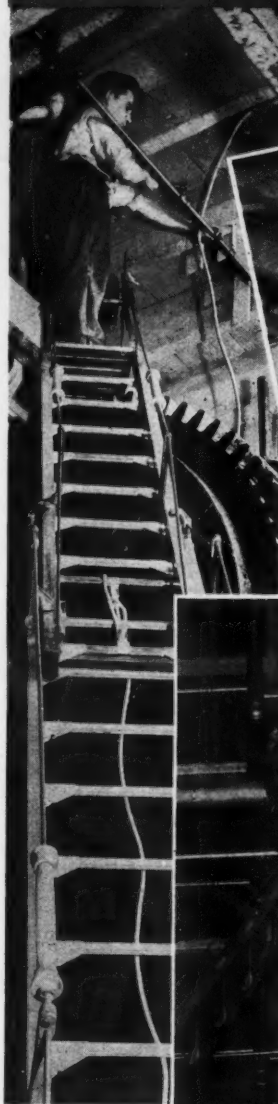
\*Based on a careful survey of present factory conditions and performance.

451-78-3290

# GENERAL ELECTRIC

# Easy overhead servicing

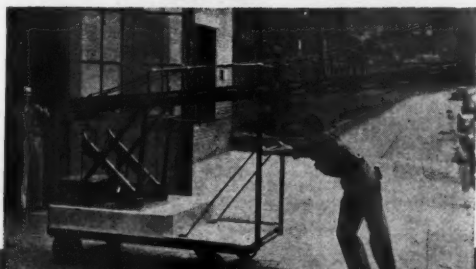
- without stops - in vital war work!



**F**AST SERVICING of indoor, high-overhead fluorescents, sprinkler heads or "what-have-you"—without stopping production, even where aisles are narrow—is accomplished with ease by reaching over bench or machine. Murray Crows' nests mounted on caster trailers or electric platform trucks are the last word in adaptiveness. Send for the convincing facts that have made this aerial ladder favorite among utilities for more than a decade. No obligation. Metropolitan Device Corporation, Brooklyn, New York.

INDOOR—OUTDOOR

## Murray crows' nest



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# Precious Time Saved!

## SPECIAL APPLETON EQUIPMENT SPEEDS MACHINERY HOOK-UPS IN WAR PLANTS!

EVANS ELECTRICAL CONSTRUCTION CO.  
and  
HATZEL & BUEHLER, INC.  
Electrical Contractors  
For United Aircraft Engine Plant  
P. O. BOX 880  
KANSAS CITY, MISSOURI  
May 27, 1943

Appleton Electric Company,  
1701-29 Wellington Avenue  
Chicago, Illinois

Mr. W. A. Tornblom, Chief Engineer

Dear Mr. Tornblom:

We wish to take this opportunity to express our appreciation for your cooperation in developing the special clamps and supports for the bus-drop cable used in the installation of the many thousand machines here at the Pratt & Whitney Aircraft Plant designed by Albert Kahn Associated Architects and Engineers, Inc.

The need of making a neat, safe, speedy, and flexible hook-up with this cable was perplexing, and neither ourselves nor the engineers of the Pratt & Whitney organization were satisfied with other installations we visited. We consider these fittings an outstanding contribution to proper wiring with this type of cable and are modestly proud of having a part together with the engineers of Albert Kahn and Pratt & Whitney in their design and development.

Where frequent rearrangement of machinery is necessary, we are pleased to endorse these fittings as being indispensable to the over all expedience of this wiring method.

Yours very truly,  
EVANS ELECTRICAL CONSTRUCTION CO.  
and  
HATZEL & BUEHLER, Inc.  
J. N. St. Clair  
J. N. St. Clair

CLAMPS AND SUPPORTS FOR BUS DUCT DROP-CABLE PERMIT SAFE EMERGENCY INSTALLATION WITHOUT CONDUIT!

Now—with the use of conduit restricted by WPB and time at a premium—machine installation in war plants is speeded up by special Appleton Fittings recently designed for use with bus duct and drop-cable for branch feeders, without conduit.

Contractors and engineers for the big new Pratt & Whitney engine plant in Kansas City were faced with the necessity of using cable, rather than conduit, for thousands of machine-tool connections. Speed and safety were paramount considerations; cable fittings exactly suited to the job were nowhere to be had.

Accordingly, Evans Electrical Construction Company and Hatzel & Buehler, Inc., called in Appleton engineers and production men, who quickly developed mooring clamps and

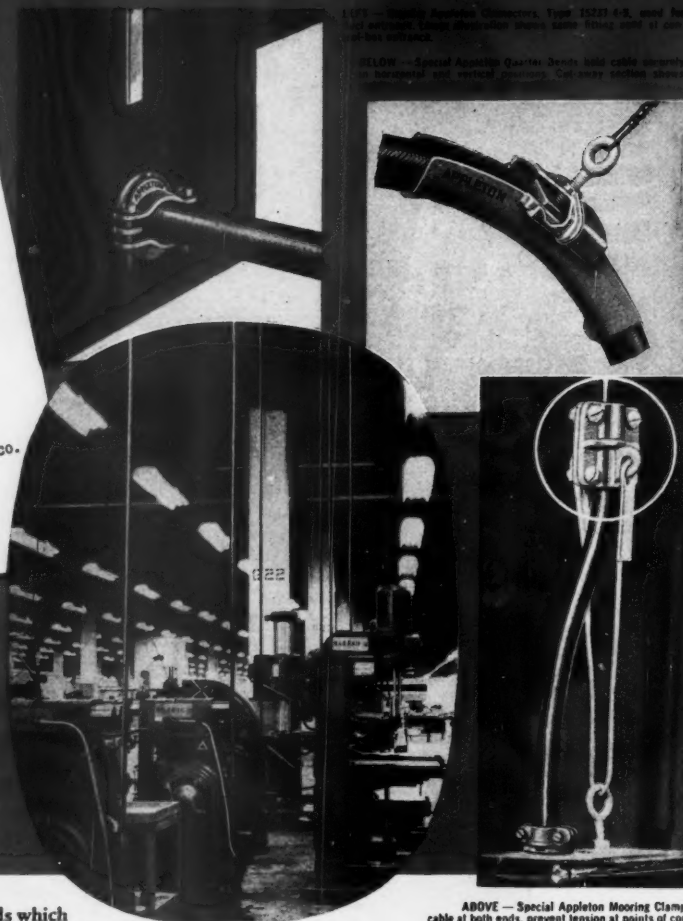
quarter-bends which anchor feeder cables securely at both ends, with no stress or pull on either connection; and keep them tight and rigid in both horizontal and vertical positions. The result is a neat, safe, time-saving installation for the war production emergency.

These special Appleton Fittings are now available for general use. They measure up fully to the Appleton quality tradition—ruggedly cast, smoothly finished, and expertly designed for quick, easy installation. Made in sizes to take cable up to 1-3/4 inch.

Whatever the requirements of any job, you can always depend on the complete Appleton Line for any fittings you need. If you have any fitting problem in war construction, put it up

1177—Special Appleton Connectors, Type 11221-A-B, used for bus and branch cable distribution system Santa Fe Aircraft Co. plant, Los Angeles, Calif.

1180—Special Appleton Quarter-Bends hold cable securely in horizontal and vertical positions. Cut away section shows



ABOVE—Special Appleton Mooring Clamps anchor cable at both ends, prevent tension at points of connection.

to Appleton! There will be no obligation and you'll receive prompt cooperation.

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Resident Representatives: Baltimore, Boston, Cincinnati, Dallas, Denver, Kansas City, Milwaukee, New Haven, New Orleans, Philadelphia, Seattle



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CONDUIT FITTINGS • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • ETC.

# Electrical Contracting

WITH WHICH IS CONSOLIDATED THE ELECTRAGIST AND ELECTRICAL RECORD—ESTABLISHED 1901

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and other shops, covering engineering, construction, wiring, maintenance and management in the field of electrical construction and maintenance.

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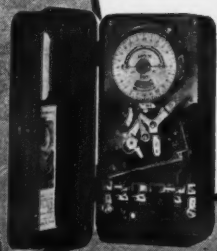
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NEVER A MISTAKE WHEN PROTECTIVE FLOODLIGHTING IS

*Automatically Controlled*



YOU HAVE A  
BIG OPPORTUNITY  
WITH  
**SANGAMO**  
TIME SWITCHES  
in Selling the  
AUTOMATIC  
CONTROL  
IDEA....



**DURING BLACKOUTS**

During any current interruptions, as for instance when a master switch is pulled for a temporary blackout, Form VSWZ Astronomic Dial Time

Switch will continue to run for ten hours. An automatic carry-over feature provides for clock-spring operation when the current is off. The clock-spring rewinds automatically when the current is restored, and the time switch resumes its normal synchronous operation.

Sell Sangamo Time Switches right along with those protective floodlighting installations. This addition of automatic control makes each installation fully dependable—the kind of assurance all vital properties serving in the war effort must have. Contrary to human traits, a Sangamo Time Switch never errs—therefore, the lights go on and off as required. There are numerous types of Sangamo Time Switches so that every protective lighting control need can be fully met. The complete line includes Astronomic Dial, Synchronous Carry-over, and Outdoor Time Switches. Our catalog describes them.



**SANGAMO ELECTRIC COMPANY** **SPRINGFIELD ILLINOIS**

# 1 Pill for 9 Headaches!

PAGES FROM "A GUIDE TO WARTIME CARE OF ELECTRIC MOTORS"

## Electric Motor Enemy No. 1...

### DUST

DUST ON IT'S WINDINGS  
"BLANKETS" MOTORS  
WITH A LAYER OF  
INSULATION.



A HANDFUL of such dust, being absorbed by motor housing...

## Electric Motor Enemy No. 2...

### STRAY OIL

OIL IS QUICK TO  
ATTACK INSULATION WHEN  
IT SOAKS IT.



BECAUSE a false friction, oil is impossible to clean. The fact of...

## Electric Motor Enemy No. 3...

### MOISTURE



1. UNWINDING, INSULATION 2. DRY OUT FIRST ELEMENTS 3. CHANGE MAY BE TOO LATE FOR IT TO BE USED

HEAVEN for a motor that can't stand a dry place. And while it is impractical to keep motors completely dry in many installations, the overvoltage should be one great use of electric power often should be made to keep motors in liquid from being damaged.

## Electric Motor Enemy No. 4...

### FRICTION



IN THEORY, no wear can take being moved and the floor under it. But within a bearing is the...

## Electric Motor Enemy No. 5...

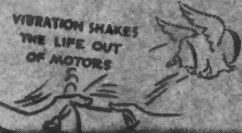
### MISALIGNMENT

ONCE MISALIGNMENT STARTS YOU  
FIGHTING EACH OTHER.



## Electric Motor Enemy No. 6...

### VIBRATION



## Electric Motor Enemy No. 7...

### UNEVEN WEAR

YOU EXPECT WEAR  
AT SOME POINTS...



(TIRE ON A CAR)

ON SLIP rings and commutators of electric motors, wear is accepted as inevitable. And as it is on the tires of a car. The reason, of course, is that none of these rotating parts exposed to constant friction can be lubricated with petroleum products.

But just as tire wear can be minimized by twisting tires around to keep road wear even -- so the wear on commutators and slip rings can be minimized by preventing conditions leading to "gripping" (concentration of heat at certain spots or spots).

## Electric Motor Enemy No. 8...

### OVERLOAD



LIKE AN OVERLOADED HORSE, A MOTOR WORKS BEYOND IT'S CAPACITY. CAPACITY IS SURE TO BREAK DOWN.

TODAY, in a world at war, the...

## Electric Motor Enemy No. 9...

### UNDERLOAD

ALTHOUGH the penalties are less severe, underloading an induction motor is just as costly as overloading it.

As indicated before, the most common flowing in an A. C. circuit is made up of two components: (1) "real" (or "active") power -- that produces mechanical energy -- and (2) "wattless" current -- that produces merely the magnetic field required in induction motors.

It is characteristic of induction motors that when they are working under only part load the power factor is low.

of wattless current is INCREASED. Technically the "power factor" (ratio of real power to total power) is lowered.

Comparing total or apparent power to a sum of a given unit, we see that wattless current is like fuel power like waste. The cost of unit, the loss of the motor.


And because there is a limit to the power capacity of generators, transformers and power lines, the character of quality of the total power is of prime importance.

ALL NINE electric motor enemies are present and accounted for in Allis-Chalmers' new "Guide to Wartime Care of Electric Motors." Streamlined instructions and story-telling pictures describe what they are, where they're found, how to fight them.

Designed for wartime U. S. industry, "Guide to Wartime Care of Electric Motors" has aroused such world-


wide demand that Spanish and Portuguese editions are now printing!

You'll find this valuable new handbook ideal both for training new men and "brushing up" old hands. It contains no advertising. Write today for *your* free copy of this tremendously successful handbook to ALLIS-CHALMERS MFG. CO., MILWAUKEE, WISCONSIN. A 1625



## ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle" — protected top, sides, ends and bottom.



WE WORK FOR  
**VICTORY**

WE PLAN FOR  
**PEACE**



**Watch  
Out  
FOR "LIVE-WIRE  
ENTANGLEMENTS"  
IN YOUR PLANT**

## **PROTECT PERSONNEL AND PRODUCTION WITH . . .**

### *Safety-enclosed Switchgear*

**D**ANGEROUS "spiderweb switchgear" like this originates as strung-out, open-type switchgear, and grows more dense and more dangerous every year that additional devices are added. It often adds up to power interruptions and accidents to personnel.

That's why compact, safety-enclosed switchgear is going not only into today's new and enlarged plants but also into scores of existent plants to replace exposed, open-type assemblies. Industry knows that its job is far too big—and its man power too precious—to trust in haphazardly exposed devices.

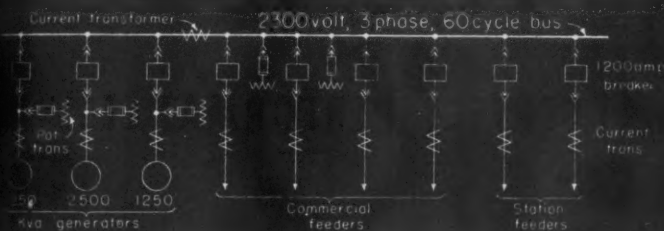
Today you can select, order, and install safety-enclosed switchgear in less time than ever before, because General Electric has *standards* to fill your needs. Standard load center unit substations, too, consisting of *metal-enclosed* switchgear and *Pyranol* transformers. Scores of war plants have kept in step with swelling power needs by installing these safe, compact, factory-assembled units instead of dangerous open-type assemblies. They give you long-term safety and dependability—save tons of vital copper.

**THIS DANGEROUS AISLE  
LINED WITH LIVE COPPER  
WAS WIPED OUT . . . .**

**... WHEN THIS MODERN  
SAFETY-ENCLOSED  
SWITCHGEAR WENT IN**

... because metal-clad includes breakers and all associated equipment—instrument transformers, buses, and connections—in one safe, compact "package."

This simple, one-line diagram enabled us to put our switchgear factory right to work on the safety-enclosed units shown at the right.



**SAFETY-ENCLOSED UNITS LIKE THESE CAN  
BE INSTALLED . . . QUICKLY**

With the one-line diagram of the electric system, General Electric engineers helped select *standard* switchgear that filled every requirement. It took a relatively short time to manufacture the standard units. They were shipped complete—on arrival, they had only to be set in place and connected.

The modern metal-clad switchgear with vertical-lift breakers took over the load, the old open-type apparatus was removed, and power was continued without interruption.

**. . . AND WITH TONS LESS COPPER**

These metal-clad switchgear units took only 47 pounds of copper each—less than one-fourth as much as open-type assemblies for the same job. This is because compact, metal-clad construction does away with the many long, strung-out copper interconnections of open-type switchgear—replaces them with a few short ones. Also because copper disconnecting switches like those on the opposite page are entirely eliminated by modern, vertical-lift breakers that can be quickly and easily connected and disconnected from the main buses.

#### **Unit Subs Save Still More Copper**

What's more, you can save immense amounts of cable copper by installing safety-enclosed unit substations—including *metal-enclosed* switchgear and *Pyranol* transformers—right at the center of the load area. Power can then be distributed to load centers at relatively high voltage. This means *short* secondary cables—and tons of copper saved.

Ask the nearest G-E office about *standard* G-E switchgear and unit substations. You can save time and copper, and get a new high degree of operating dependability and safety. *General Electric, Schenectady, N. Y.*



Safety-enclosed unit substation, including *Pyranol* transformer and drawout air breaker equipments, installed indoors at a load center.

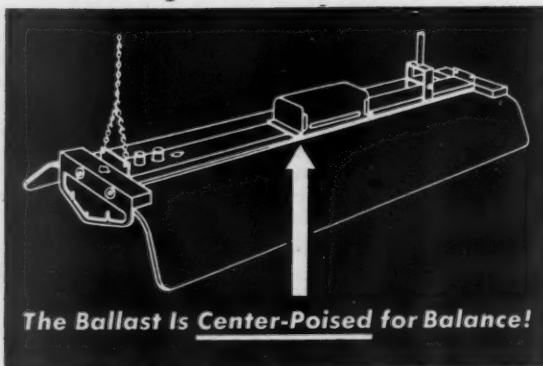
**GENERAL ELECTRIC**

The New **Guth** MAZE-LITE

*Center Poised*

FOR PERFECT PERFORMANCE!

*Study the Features of this Amazing Unit!*



- 1** MASONITE REFLECTOR-BOARD REFLECTORS — Conform with WPB Steel Limitations.
- 2** EXPOSED BALLAST, for cooler operation and longer ballast life.
- 3** EXPOSED STARTERS can be removed without removing lamps.
- 4** GROOVED CHANNEL reinforces channel, also used with sliding hangers.
- 5** BUILT-ON CHAIN STRAPS—integral part of channel assures "center poise" ride of ballast in Fixture.
- 6** BUMP-PROOF ENDS—stamped with recessed panel reinforcing to insure lampholder protection.
- 7** TWO-END KNOCKOUTS—combination knockouts for locking units together or for pull switches.
- 8** FOR EGGRATES—slot in standard ends for attachment of new eggcrate louvers.
- 9** LINE-UP HOLE—use when desired with bolt and nut for perfect line-up continuous runs.

★ ★ ★ ★ ★ ★ ★ ★  
*Leaders in Lighting Since 1902*

**Guth**

THE EDWIN F. GUTH CO. • 2615 Washington Ave. • St. Louis, Mo.

# The Transformer THAT MADE THE Load-center Unit Substation Possible

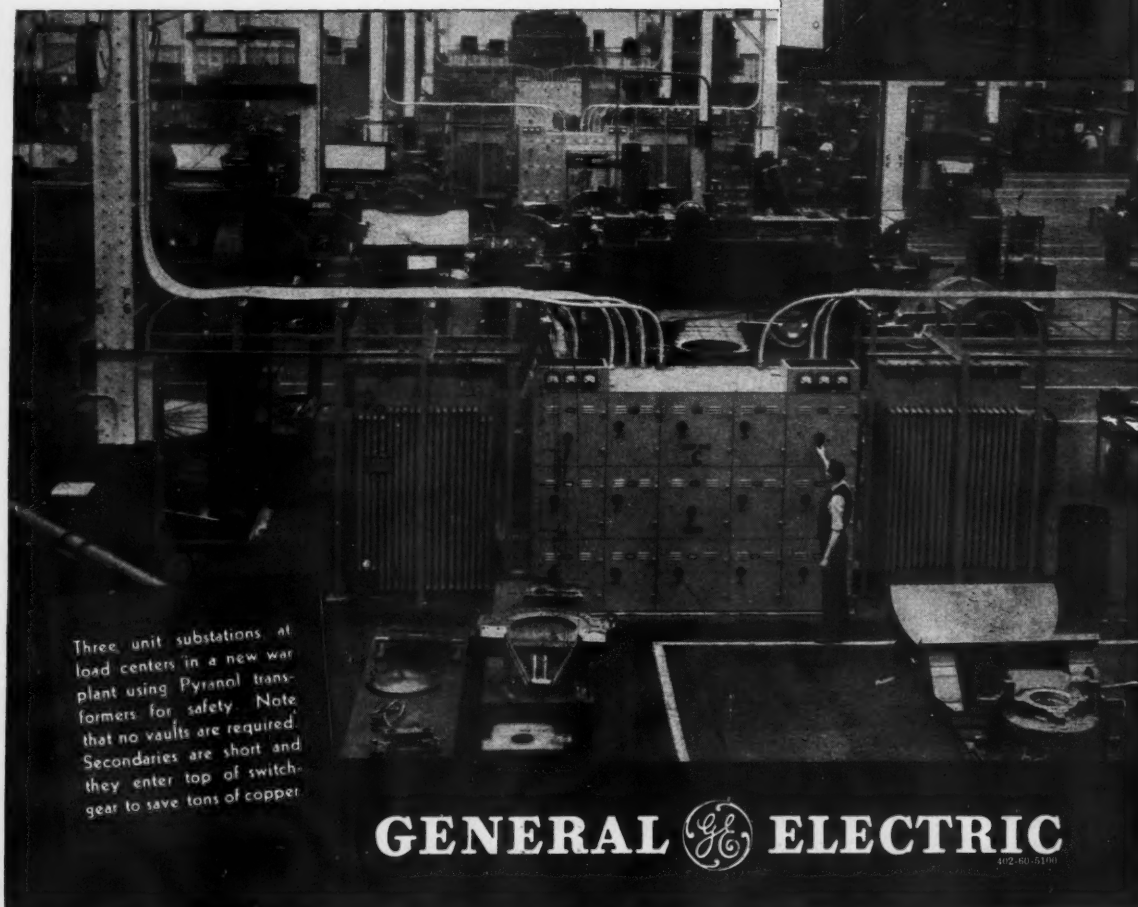
THE inherent safety of Pyranol\* transformers led to the development of the modern load-center system of power distribution. It made possible the basic element of such a system, the load-center unit substation.

In turn, these easy-to-order, easy-to-install unit substations enable war plants to get rolling months sooner than would be possible otherwise. And because Pyranol transformers permit installation in or near the working areas, the elimination of long secondaries is saving thousands of tons of copper. Power losses are reduced, and voltage regulation is improved.


Remember, too, that Pyranol transformers are *all-purpose* units. Whether or not unit substations are called for, Pyranol permits installation anywhere you wish, indoors or outdoors, above ground or underground, in places wet or dry, clean or dusty. Whatever location you choose, these transformers will simplify your installation problem, and will supply the power for your war loads with little or no maintenance. Write for Bulletin GES-2974. General Electric, Schenectady, N. Y.

\*Reg. U.S. Pat. Off.

--- the All-purpose  
PYRANOL TRANSFORMER  
for Safety and Savings



Three unit substations at load centers in a new war plant using Pyranol transformers for safety. Note that no vaults are required. Secondaries are short and they enter top of switchgear to save tons of copper.

**GENERAL  ELECTRIC**  
612-ND-5101

# GREAT NAMES in American Progress



**ROBERT FULTON, BOAT BUILDER** — On a fateful Friday in 1807, a skeptical crowd gathered at the foot of Cortlandt Street, New York. They came to watch "Fulton's Folly" attempt the "impossible" by traveling without sails from New York to Albany. Those who came to jeer stayed to cheer. "Crazy" Bob's puffing, snorting Clermont wheezed away from the jetty and grunted upstream against the wind at the miraculous speed of four miles an hour. On that day, Robert Fulton, well-nigh penniless dreamer, revolutionized the water-borne transportation of the world.

## AMERICAN BLOWER

American Blower products have contributed much towards the progress of American industry — progress that today is making it possible for America's vital industries to outproduce the world. In the great public utilities, the steel industry, in the manufacture of petroleum products, chemicals, in food processing, mining, smelting and refining, in hospitals, schools, public buildings and homes, American Blower air handling equipment has kept pace with progress.

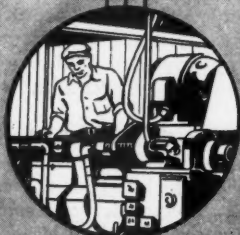
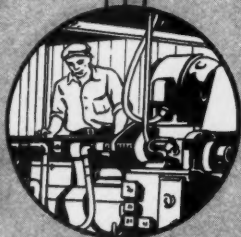
**CONTRACTORS—DEALERS**—We're working 100% for victory. But you can still buy American Blower products for vital war work. After victory we'll be ready with the most complete line of heating, ventilating and air handling equipment in history.



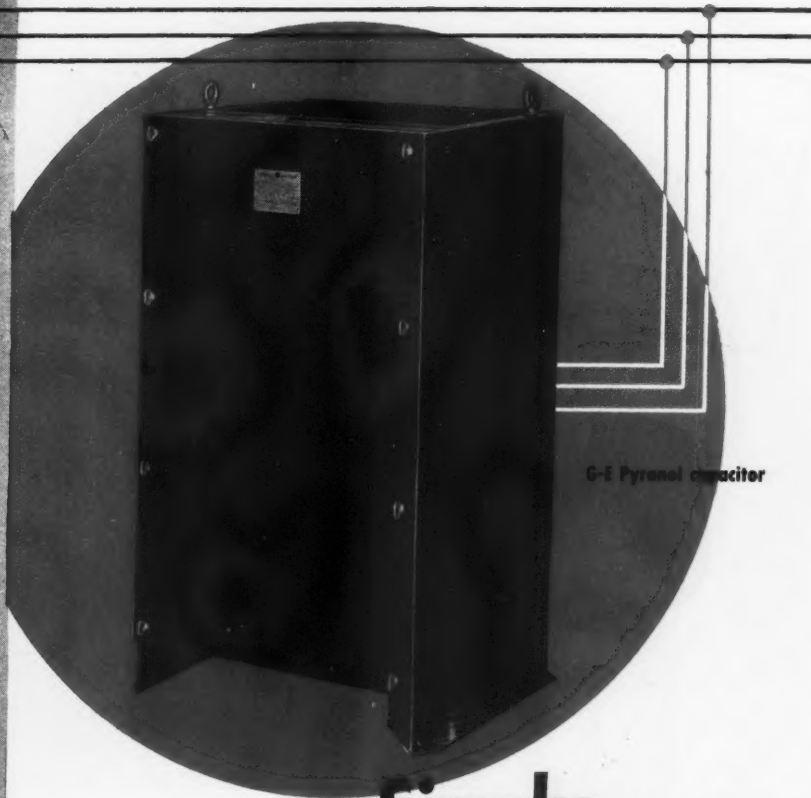
**AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN**  
**CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO**  
 Division of **AMERICAN Radiator and Standard Sanitary Corporation**



Utility Set



10 to 40% more load



G-E Pyranol capacitor

## Simply by Adding *Pyranol\* Capacitors*

**You Can Make a Circuit Carry 10 to 40% More Load**

**C**APACITORS can help, if your plant's power system is fully loaded—or overloaded—and is operating at low power factor. How? The effect of a capacitor is to supply reactive kva that otherwise has to travel through your transformers and feeders. The circuit is, thus enabled to carry more *working* current—as much as 40 per cent more in some cases.

Improvement of power factor by the addition of Pyranol capacitors will also: (1) Reduce load and heating of transformers and feeders, (2) Improve voltage conditions on the circuit, (3) Reduce energy losses.

You get results quickly when you install capacitors—a matter of weeks instead of the months necessary to get the same results with other methods. Standard ratings to meet practically all plant conditions are available. Installation is merely a matter of placing the capacitor in position and making connections.

Ask your G-E representative today to estimate the possible increase in your circuit capacity, or write for Bulletin GEA-77. *General Electric, Schenectady, N. Y.*

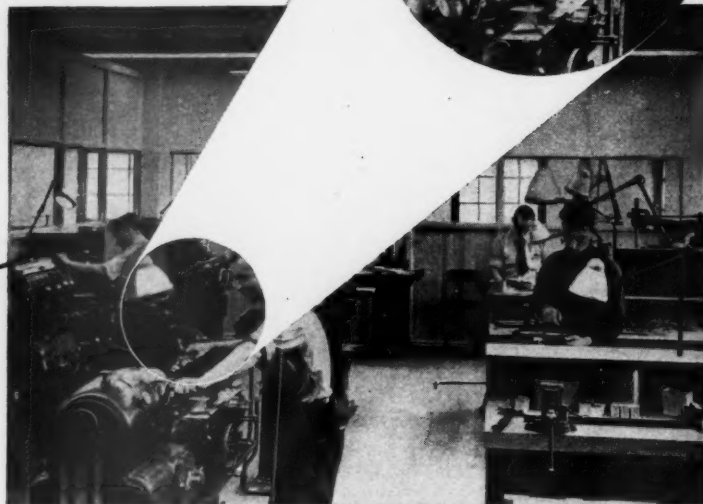
\*General Electric's trade name for a synthetic liquid dielectric that will not burn.

**GENERAL  ELECTRIC**

407-55-5700

# SAVE WITH "Balanced" Lighting BETTER SEEING AT LOWER COST

Light for Seeing is one of the worker's most vital tools—so an efficient lighting system is based on his "seeing" needs.



Good illumination engineering in industry provides each worker with adequate light for seeing efficiently all that is required to perform his tasks quickly and economically. Such results can be obtained only through choice of the proper type of lighting equipment properly positioned according to the worker's individual requirements.

"Balanced lighting" installations achieve these desired results most satisfactorily. A "balanced lighting" recommendation provides the proper proportions of "localized" lighting for the critical work areas—varying from 100 to 300 footcandles and more. It also provides "general" lighting for overall illumination of work areas and surroundings at ratios of 1 to 5 with "localized" requirements.

"Balanced lighting" requires a minimum of equipment and saves substantially in initial investment, operating and maintenance costs.

**THE FOSTORIA PRESSED STEEL CORPORATION, Fostoria, Ohio**  
In Canada — Write Amalgamated Electric Corp., Ltd., Toronto



**Saves** **Saves** **Saves** **Saves** **Saves**  
Critical Power Worker's Time Invest-  
Material Eyes ment



## For Study and Counsel on Your Lighting Problems

Fostoria Industrial Service Centers located strategically in principal cities throughout the United States and Canada, are properly equipped and well qualified to solve your lighting problems. This service determines first, what each worker's seeing requirements are on the job so he may work faster, accurately, safely, with a minimum loss of efficiency. It carries on to analyze specifically the kind, quantity and distribution of lighting which will properly provide the worker's seeing needs. It then selects and positions the lighting equipment to meet these specifications and stands ready at all times to help maintain this equipment at top efficiency.

# NEW

## TOTALLY ENCLOSED TRI-CLAD MOTOR



1/2 to 2 HP

### FOR "CRUEL" SERVICE CONDITIONS LIKE THESE

(Meeting requirements of WPA  
Motor Conservation Order L-221)

#### DESTRUCTIVE DUSTS\*

Where rock dust, metal filings, powdered chemicals, or other finely divided materials are present in destructive quantities.

#### CORROSIVE FUMES\*

Where motors are exposed to corrosive acids and alkalis in liquid or vapor form, such as on mixers in chemical pilot plants.

#### GUMMY, VISCOUS MATERIALS

In working with paints, oils, syrups, and other materials which might "gum up" the interior of an open motor.

#### SUPERSATURATED ATMOSPHERES

Where motors must operate without fail in areas filled with steam, water vapor, oil droplets. Also out of doors in humid, stormy climates.

\* In addition to this standard totally enclosed Tri-Clad motor, G. E. can furnish explosion-proof types, tested and listed by Underwriters' Laboratories, Inc., for (1) hazardous dusts, such as magnesium dust, coal dust, grain dust, (2) hazardous fumes, such as gasoline.

### FULLY ARMORED AGAINST THE ENTRY OF DESTRUCTIVE MATERIALS—RESISTANT TO CORROSION AND EXTERNAL DAMAGE

On this new member of the Tri-Clad motor family, end shields and frame are solid cast iron, smoothly contoured and tightly fitted. Ball bearings are protected by a rotating-labyrinth bearing seal—against damaging dusts or liquids. The leads are sealed in compound in a cast-iron pocket in the frame. Inside, the motor has all the extra-protection features of Tri-Clad open motors, such as Formex\* wire.

An outstanding feature of these new motors is that their mounting dimensions are interchangeable with those of open motors of like rating.

For complete information on the totally enclosed Tri-Clad,

\* Reg. U.S. Pat. Office

FRAME SIZES			
Hp	Rpm	Poly-phase	Single-phase
1/2	900	204	
3/4	1200	203	204
3/4	900	224	
1	1800	203	203
1	1200	204	
1	900	225	
1 1/2	3600	203	203
1 1/2	1800	204	204
1 1/2	1200	224	
2	3600	204	204
2	1800	224	

see your G-E representative, or write to General Electric Co., Schenectady, N. Y.

# GENERAL ELECTRIC

## Why Stu doesn't need to know "overload" exists

Stu is top-turret gunner on a 4-engine bomber.

He knows a whale of a lot about operating his turret and his gun. But he doesn't know anything about "overload" . . . doesn't care to know . . . doesn't have to know.

*Here is why.*

Some time ago, electrical-design engineers recognized that the motors operating any gun turret would have to meet extreme conditions of overload. The turrets stop and start quickly in battle. Sometimes they must work against the air stream. They must be *small* in comparison to the horsepower they deliver.

Taking care of this overload naturally involved an insulation which could stand a high temperature rise. To get such an insulation, the electrical industry sought out Fiberglas\* Electrical Insulations and combined them properly with the newest impregnants.



In addition to withstanding overload, these Fiberglas combinations are very light in weight, have a low space factor, and excellent moisture resistance.

Today, almost all American aircraft contain motors no larger than your fist up to babies big enough to start the engines. Most of them are Fiberglas-insulated.

The aviation industry's demands for Fiberglas have been constantly growing because of an *increasing* use of Fiberglas in an air force which is *expanding*.

Besides, both Army and

Navy are using more and more Fiberglas in many other types of equipment as well as for wire and cable insulation.

Although Fiberglas production was greatly expanded last year and is now being increased every month, vital war demands have so far kept pace with this expansion.

These are the reasons why your electrical distributor may not have been able to fill your orders promptly. Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.



# Fiberglas Electrical Insulations

PT. M. Reg. U. S. Pat. Off.

# Tools for Machining Aluminum

FOR GENERAL MACHINE SHOP PRACTICE

**TOOLS** for machining aluminum should generally have a more top and side rake than is common for machining steel; the cutting edges should be keen and the tool surfaces should have a smooth, bright finish.

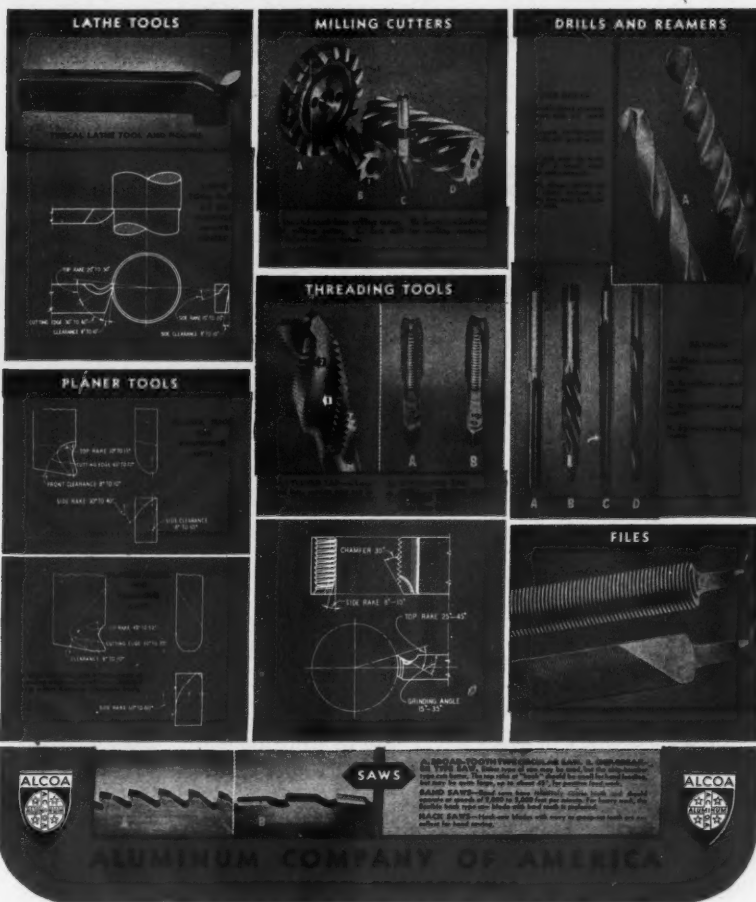
In the following illustrations, a wide range of rake angles is indicated. In general, the larger rake angles are employed for finishing tools and for the aluminum alloys that are not free-cutting; this includes the softer materials which require tools with exceptionally acute and keen cutting edges. On the other hand, rake angles

in the lower range are used for roughing cuts and for machining the alloys that have free-cutting characteristics. Tools similar to those used for machining steel may often be employed successfully.

**TOOL MATERIALS**—High-carbon steels are good for many jobs where the cutting speed is low. High-speed tool steels are better for quantity production. Cemented-carbide-tipped tools are superior to high-speed tool steels, especially for aluminum alloys with a high silicon content.

**CUTTING SPEEDS AND FEEDS**—Generally, aluminum can be machined to best advantage by using the highest speed at which the equipment is capable of operating, with moderate feeds and cuts.

**CUTTING COMPOUNDS**—Use a copious amount of cutting compound. Soda water or soluble oil may be used for milling, drilling, and sawing operations. Mineral oil with the addition of 5 to 10 per cent fatty oil, such as lard oil, is an excellent lubricant. A 50-50 mixture of kerosene and lard oil gives excellent results.



HANG ONE  
OF THESE  
CARDS  
IN YOUR  
SHOP

The information printed on this large card (14" x 20") will answer many questions for machine operators, to whom the machining of aluminum is new. Use this coupon to send for a copy or write us on your company letterhead—

ALUMINUM COMPANY OF AMERICA  
1946 Gulf Building, Pittsburgh, Pa.

Please send me your wall card on "Tools for Machining Aluminum."

NAME \_\_\_\_\_ TITLE \_\_\_\_\_  
COMPANY \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
TOWN \_\_\_\_\_ STATE \_\_\_\_\_

## New Army Gliders Dressed Up and Waiting for Aerial Escorts



These big Army gliders are lined up at [redacted] waiting for towing planes.

Herald Tribune—Acme

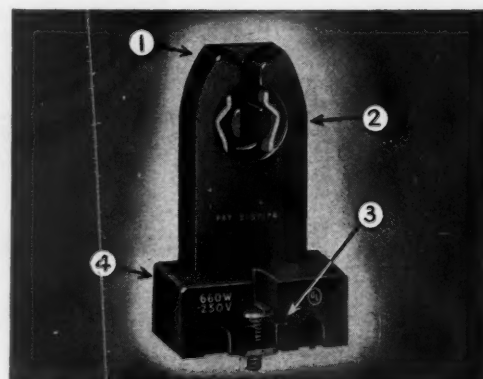
## BACK OF EVERY INVASION STORY

Behind the scenes—back of every advance of fighting men—is a story of *fighting* production. A story of men and women working shoulder to shoulder in plants better equipped, more modern than any ever known before!

To this war of production, the Bryant Electric Company is today contributing its full facilities, providing electrical devices on some of America's greatest installations. Typical is the Bryant Fluorescent Lampholder No. 4300.

Ease and speed of replacement are features of this lampholder.

1. Slot-finding feature facilitates replacement of lamps.
2. Heavy spring contacts hold lamp firmly and provide positive electrical connection.
3. Slot for mounting screw or nut makes it possible to mount lampholder with maximum reflector clearance.
4. Body made of extra strong bakelite. Choice of black or white.



Now more than ever... every outlet deserves a reliable Bryant device. Sold through electrical wholesalers.

THE BRYANT ELECTRIC COMPANY • BRIDGEPORT, CONNECTICUT

NEW YORK

• SAN FRANCISCO

• CHICAGO

• LOS ANGELES

# Each SWITCHBOARD

## is an individual problem

The one you need may be different from any other. It depends on the job it will be required to do.

Future expansion must also be taken into consideration when planning the switchboard. It should be so designed as to permit of modernization (should improvements in design and functioning be made), and increase of capacity when needed.

ⓕ Live Face Switchboards are available when desired, or when conditions require them. The trend is to safety in electrical equipment, however, and ⓕ Safety Type Switchboards are rapidly replacing Live Face equipment. These include both switch and fuse and circuit breaker construction.

### ⓕ SHUTLBRAK

ⓕ Shutlbrak Switch units are built in capacities of 30 to 1200 amperes, inclusive, for 250 volts AC or DC, and 575 volts AC, in 2, 3 and 4 poles. Approved by Underwriters' Laboratories, Inc.

### ⓕ CIRCUIT BREAKER

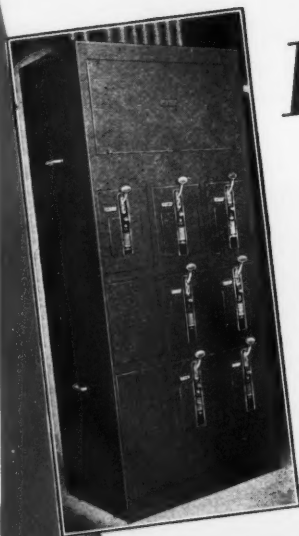
ⓕ Circuit Breaker Type breakers are 2 or 3 pole thermal type. Maximum capacities are 600 amperes, 250 volts AC or DC, and 575 volts AC. For larger capacities, air or oil circuit breakers are used. Approved by Underwriters' Laboratories, Inc.

### ⓕ KLAMPSWITCHFUZ

ⓕ Klampswitchfuz units are made in capacities from 30 to 1800 amperes, inclusive, 250 volts AC and DC; also 30 to 600 amperes, inclusive, 575 volts AC, in 2, 3 and 4 pole types, single and double throw. They are approved by Underwriters' Laboratories, Inc., as operating switches in capacities of 600 amperes and less, 250 volts AC and DC, and 200 amperes or less, 575 volts AC. All other capacities are approved as disconnect switches only.

### For the latest Engineering Data on ⓕ Switchboards

consult an ⓕ Sales-Engineer. By long experience, he is competent to help Architects, Engineers and Specification Writers in problems of designing and specifying electrical installations. Write for name and address of the one nearest you. No obligation. . . . . Frank Adam Electric Company, St. Louis, Mo.

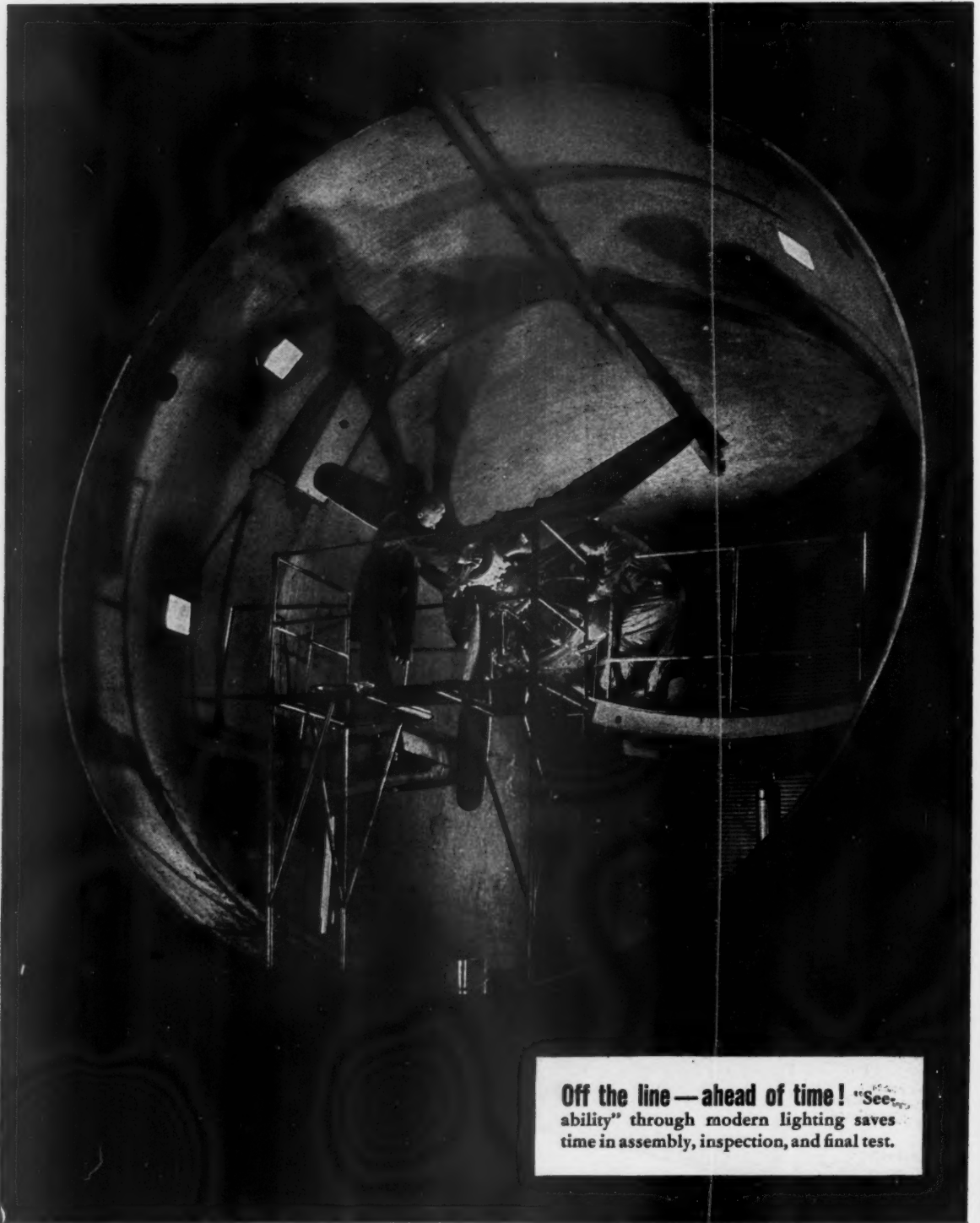


At top:  
ⓕ Shutlbrak  
Switchboard

At center:  
ⓕ Circuit Breaker  
Type Switchboard

At bottom:  
ⓕ Klampswitchfuz  
Switchboard

# **"SEE-ABILITY" helps**



**Off the line—ahead of time!** "See-ability" through modern lighting saves time in assembly, inspection, and final test.

# build motors faster

**Motors are coming** off the lines, faster and faster... each a promise of Victory—ahead of schedule. • To insure the success of this vital war work, millions of Westinghouse Mazda lamps are needed daily—needed to provide better "See-ability" for all our workmen in foundries, machine shops, in production and inspection departments everywhere! To make these lamps available, we must draw upon limited supplies of nickel, copper, tungsten. • That's why, in our advertising, we are asking all users to conserve their lamps, to help stretch further the nation's supply of critical materials. Westinghouse Electric & Mfg. Co., Lamp Division, Bloomfield, N. J.



## "SIGHT FOR VICTORY" PROGRAM

Everyone interested in speeding our war effort through improved "See-ability" for war workers, can help by cooperating with the National Better Light—Better Sight Bureau's "Sight for Victory" Program. For full details, write Westinghouse Electric & Manufacturing Co., Lamp Division, Bloomfield, N. J., or get in touch with the Better Light—Better Sight Bureau, 420 Lexington Ave., New York, N.Y.



# Westinghouse

## MAZDA LAMPS

FOR GREATER "SEE-ABILITY"

## To locate branch offices...



**When you're working** with suppliers, especially new ones, you want fast, on-the-scene service whenever you can get it. You can't keep track of branch offices too readily, but your 1943 E-B-R (Electrical Buyers Reference) can and *does*. Right in the helpful BRIEFALOG\* section, you'll find most of the 290 manufacturers listing branch offices, sales representatives, local supply centers. And that's just one of the many time-saving E-B-R features!



*\*E-B-R's own original version of modern condensed cataloging.*

### IF IT'S ELECTRICAL ...LOOK IT UP FIRST IN **E-B-R**

*Now more complete than ever before, your 1943 Electrical Buyers Reference gives you:*

**MANUFACTURERS BRIEFALOG SECTION**—Condensed catalogs of 290 manufacturers. Product specifications, branch offices, warehouses, etc.

**CLASSIFIED DIRECTORY**—Company addresses and trade names, arranged by product. Extensive cross-references to help you find the electrical and allied products made by more than 3,500 manufacturers.

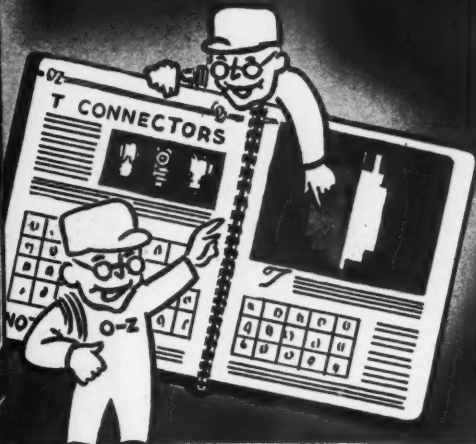
**INDEX OF TRADE & COMPANY NAMES**—Complete with addresses. Starting with only a trade name or a company name, you can thus quickly locate the product data you need.

**A WORD OF EXPLANATION**—E-B-R is not sold, and is not offered as a premium for subscriptions to any magazine. It is distributed to a limited number of men directly responsible for the specifying or requisitioning of substantial amounts of electrical materials.



McGRAW-HILL PUBLISHING COMPANY, 330 W. 42nd ST., NEW YORK, N. Y.

# NEW O-Z CATALOG



## Covers

### COMPLETE O.Z. LINE OF

- CONDUIT FITTINGS
- CABLE TERMINATORS
- SEALING GLANDS
- SOLDERLESS CONNECTORS
- POWER CONNECTORS
- GROUNDING DEVICES

Including New Fittings—Useful Engineering Data—More List Prices—More Complete Dimensions.

**FREE**—to engineers and executives. If you have not already requested your copy, mail this coupon attached to your company letterhead. The new O. Z. Catalog (ready for distribution in August) will be mailed—without obligation, of course.

*Keep Buying War Bonds*

# O. Z.

## ELECTRICAL MFG. CO.

262 BOND STREET • BROOKLYN, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

### NOTE THESE ADDED FEATURES

- FLAT-OPENING PLASTIC BINDING
- NEW PHOTO-DIAGRAMS
- THREE INDEXES—PICTURE, PRODUCT, CATALOG NUMBER

O. Z. ELECTRICAL MFG. CO.  
262 Bond Street, Brooklyn, 2 N. Y.  
Send me the new O. Z. Catalog.

Name \_\_\_\_\_ Title \_\_\_\_\_

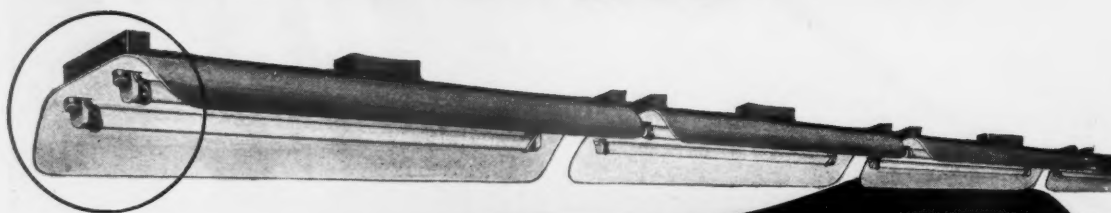
Company \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

4065

# MILLER DOES IT AGAIN!



...with a patented **SAFETY LAMP LOCK**  
which prevents lamps from falling!

**STUDY CAREFULLY** the details of the MILLER patented Safety Lamp Lock as shown at the right. It is an integral part of each socket—prevents lamps from falling.



**There are several** highly significant features of the new MILLER Aero-Designed fluorescent fixture, and its compliance with WPB regulations limiting the use of steel.

Of all features, none is more noteworthy than the MILLER Safety Lamp Lock. The vital spots where it gets in its good work are shown in the circled sockets in the continuous run of fixtures at the top of the page, with the details diagrammed immediately above.

It is an extremely important feature to you . . . because it minimizes the risk of lamps falling from sockets. Fool-proof under all conditions, it can mean the saving of time and money in your busy plant . . . yes, the prevention of dangerous accidents, too.

This Safety Lamp Lock is *exclusive* with MILLER.

It's a product detail that undoubtedly is one of the best available demonstrations of the constant alertness of MILLER lighting engineers in your interest. It's your best reason for calling in a MILLER field engineer (located in principal cities) today, to talk more about this Aero-Designed fluorescent lighting, and how it can help you.

## Other Noteworthy features

**FLANGED TOP CHANNEL** simplifies installation—saves labor.

**"EXTRA LENGTH" REFLECTORS**—shield lamp ends—of sturdy Masonite with reinforcing attachment straps.

**IVANITE** the "sealed-in-surface" finish—durable, easy to clean, high reflection factor.

**STREAMLINED**—completely wired channel with exposed ballast for heat dissipation.

## THE MILLER COMPANY • MERIDEN, CONNECTICUT

**ILLUMINATING DIVISION**  
Fluorescent, Incandescent  
Mercury Lighting Equipment

**OIL GOODS DIVISION**  
Domestic Oil Burners  
and Liquid Fuel Devices

**ROLLING MILL DIVISION**  
Phosphor Bronze and Brass  
in Sheets, Strips and Rolls

**WAR CONTRACTS DIVISION**  
War Material



# ACCENT ON sure starters



War production plants are now running "in high gear and wide open." As every engineer knows that's the time to watch details . . . to see that little things don't cause big shut-downs. Thousands of manual starters, for example, are being operated more frequently today than ever before. Most of them are vital links in the production chain. If any of this equipment under your supervision is obsolete or worn out, **NOW** is the time to replace it. The extra stamina and extra service features built into Trumbull Manual Starters . . . a service "dividend" in peace-time . . . are an essential safeguard now. Let them help you hold the pace.



## "TM-2" . . . "TM-7 1/2"

Single throw enclosed manual starters with interchangeable and self-resetting relay heaters for thermostatic overload protection. Made in 2 and 3 pole, maximum 2 H.P. at 110-550V A.C. ("TM-2"), 7 1/2 H.P. ("TM-7 1/2")—for across-the-line A.C. motors . . . line fuses must be used to protect heaters against short circuit. No remote or automatic control. Low cost and maintenance. Described in Circular 308.



## IMPORTANT FEATURES OF "TM" STARTERS

**DUO-BREAK VERTICAL CONTACTS** prevent dust accumulation, reduce arcing and flashover to a minimum, longer wear.

**VISIBLE CONTACTS & CURRENT CARRYING PARTS** for easy inspection, removal and replacement **FROM FRONT**.

**OPERATING HANDLE** of ample size, protected with guard. Locks in "on" or "off" position.

**ENTIRE MECHANISM** on single molded base removable from front for easy wiring.

**RELAY HEATERS** plainly marked, interchangeable in all ampere capacities. Overload trip automatically resets after overloads. Approved and listed by Underwriters' Laboratories, Inc.

TRUMBULL  
"T.T."  
STARTER



Thermostatic Tumbler switches for small machine control. Has the same general features as "TM" starters. Maximum ratings 1 H.P. = 220V A.C. and D.C. Used primarily for starting fractional motors on the smaller machine tools, oil burners, pumps, etc. Described in Circular 317.

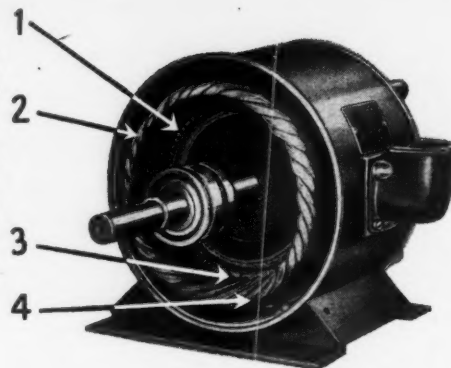
THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O.—SEATTLE—SAN FRANCISCO—LOS ANGELES

**NEW INSULATION  
DEVELOPMENTS GIVE**  
*Longer Life...*

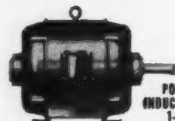
## *R & M Uni-Shell* **INTEGRAL HORSEPOWER MOTORS**

*I*mportant improvements in insulating technique, plus heat-testing of each design with thermocouples imbedded in the windings, insure cool operation with sharply increased life expectancy for every R & M Uni-Shell Motor. Four features of this insulation are indicated in the accompanying illustration. 1. Two layers of the highest-grade impregnated rag paper. 2. Wire coated with double-weight synthetic resin for greater insulating strength. 3. An extra sheet of impregnated paper placed between coils in slot, and a new method for holding and insulating end coils. 4. Entire winding assembly given several baked coats of synthetic resin-base varnish and covered with moisture-resistant synthetic resin and tung-oil sealer. . . . By actual test we can say that the Uni-Shell Motor meets all temperature guarantees—inside and out.

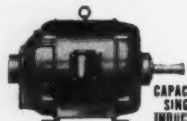


### **ONLY END HEADS CHANGE**

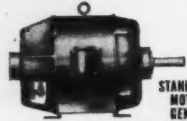
Every dimension, from body to head fit, identical for all motor types.



**POLYPHASE  
INDUCTION MOTOR**  
1-30 H. P.



**CAPACITOR START  
SINGLE-PHASE  
INDUCTION MOTOR**  
1-5 H. P.



**STANDARD D. C.  
MOTOR AND  
GENERATOR**  
1-7½ H. P.  
¼-5 H. W.



**REPULSION  
INDUCTION MOTOR**  
1-5 H. P.

### **ALL MOTOR TYPES INTERCHANGEABLE**

All types in any one frame size in the new Uni-Shell motor line are interchangeable and similar in appearance. Every dimension and detail, from Uni-Shell motor body to head fit, is identical—only the end heads change. And in these cylindrical shells of steel are the finest, longest-lived motors that R & M has built in nearly 50 years of motor specialization. Advances in bearing quality and alignment, precision-balanced rotors, better insulation, cooler interior ventilation and many other features contribute to new high standards of efficiency and performance.

Whether you use motors as a part of your product, or only on the machines in your plant, the advantages of interchangeable motor types, together with the new motor efficiency, are easy to see. Write for your copy of our new 20-page illustrated book on R & M Uni-Shell Motors.

### *Mail Coupon* FOR NEW 20-PAGE UNI-SHELL BOOKLET



ROBBINS & MYERS, INC., Springfield, Ohio

Gentlemen: Please send me your new 20-page booklet on Uni-Shell Motors.

Name.....Position.....

Company.....

Street Address.....

City.....State.....

I would ☐ would not ☐ like to talk to a representative. E.C.1

**ROBBINS & MYERS • INC.**

MOTOR DIVISION, SPRINGFIELD, OHIO

HOISTS & CRANES • MACHINE DRIVES • FANS • MOYNO PUMPS • FOUNDED 1878

# *This* CONSERVATION PLAN *will help you* **SAVE MAN-HOURS... SAVE MATERIALS...SPEED PRODUCTION**

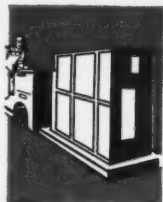


## **1. Conserve**

by strategic selection, application and use of electrical equipment.

### **EXAMPLE**

"Factory-packaged" equipment saves installation time and materials. An illustration of this is the Westinghouse "Power Center" which combines all transformer and switching equipment into one ready-to-use unit.

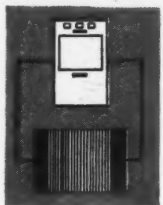


## **2. Conserve**

by utilizing new developments that reduce need for critical materials and man-hours.

### **EXAMPLE**

High-frequency heating reduces, by as much as 95%, the curing time required for producing thick plywood, plastics and other nonmetallic substances.



## **3. Conserve**

by utilizing available facilities for preventing breakdowns and reducing machine outages.

### **EXAMPLE**

"Maintenance Hints"—a complete, pocket-size manual covering recommended upkeep practice for electrical apparatus—is a maintenance help available without charge. Check your Westinghouse representative for copies.



## **4. Conserve**

by utilizing materials which in many cases can replace critical materials and do a better job.

### **EXAMPLE**

Phos-Copper brazing alloy is easing bottlenecks created by a shortage of tin solders for joining metals. In some cases, one pound of Phos-Copper eliminates the need for as much as 12 pounds of tin.



## **5. Conserve**

by tapping all sources of salvageable scrap.

### **EXAMPLE**

Systematic planning can uncover many ways of reclaiming worn equipment and waste material. Samples of salvage forms and organization charts in use in Westinghouse plants will gladly be made available on request.



Wartime Conservation means **MORE** than just conserving copper, steel, aluminum... it means the most strategic possible use of all of the ingredients of Victory—materials, man power, time and ingenuity.

These five major points comprise a complete program developed by Westinghouse for Wartime Conservation. This program packages up Westinghouse engineering experience in the entire field of electric and power equipment and related materials. Examples noted are but five of many specific recommendations.

This experience and these recommendations are offered fully and without obligation.

Ask your Westinghouse representative today for a copy of the new 100-page book, "WAR-TIME CONSERVATION." Or write direct to Dept. 7-N, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. J-99483



# Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

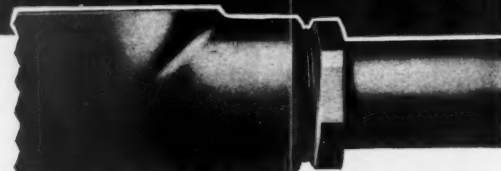
# NEW CONDULETS

for

## Electrical Metallic Tubing

(Thin Wall Conduit)

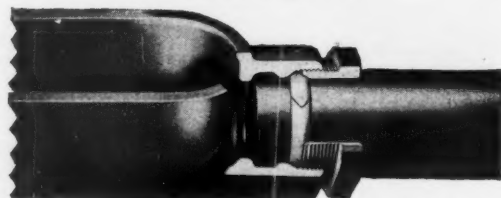
- **A Complete Line**—Condulets to provide outlets for light, power, switching, junction boxes, etc.
- **Ease of Installation**—Simply insert the tubing and tighten the clamping nut, which has a broad hexagonal head easy to grip with any wrench.
- **Rigid Joint**—The compressed gripping bites into the tubing, providing a strong rigid joint.
- **Continuity of Ground**—Intimate contact provides a dependable race-way ground.
- **Internal Threads**—Safe from bruising in handling or installing.
- **Alignment**—Perfect alignment with existing rigid conduit installations.
- **Tubing Fit**—The accurately machined clamping nut assures a close fit with the tubing.
- **Sizes**—For electrical metallic tubing from ½-inch to 2-inch.



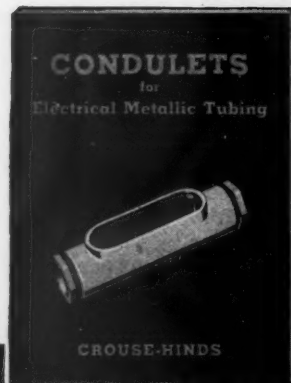
Assembly of Condulet and Electrical Metallic Tubing



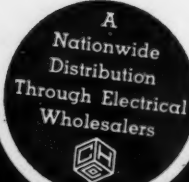
Exploded View of Condulet Showing "Fish-tail" Grip-Ring and Clamping Nut



Sectional View Showing Action of Nut and Grip-Ring on Electrical Metallic Tubing



Send for Bulletin No. 2570 which contains complete listings of Condulets for electrical metallic tubing.



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VARNISHED CAMBRIC • RUBBER POWER CABLES • BUILDING WIRE • RADIO

# CRESCENT

**Gives You  
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**For Example,  
These Two Among Many**

## VARNISHED CAMBRIC POWER CABLE

A widely used cable for general industrial power purposes. Varnished Cambric insulation provides higher current carrying capacity for same size of copper conductors.

## CRESFLEX NON-METALLIC SHEATHED CABLE

A factory-assembled wiring system that is easily installed at low cost. Especially suitable for war housing, industrial and all interior wiring. Uses no steel or zinc.

**WAR PRODUCTION 100%**

**Crescent Insulated Wire & Cable Co.**



## CRESCENT WIRE and CABLE

*Factory: TRENTON, N. J. — Stocks in Principal Cities*

**CRESCENT ENDURITE SUPER-AGING INSULATION • WEATHER-PROOF WIRE**

*Electrical Contracting, July 1943*

27

CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

WIRES • SIGNAL CABLE • FLEXIBLE CORDS • LEAD-ENCASED AND PARKWAY CABLES • ARMORED CABLE



# WISSCO

## ARMATURE BINDING WIRE

**Tinned, high tensile wire  
available in all grades  
Prompt deliveries**

### **Plus Everything in Wire**

Here at wire headquarters you will find everything you need, not only *Wissco quality* Armature Binding Wire, but high and low carbon steel wire—round, flat or shaped . . . wire for springs and for hundreds of other applications, in a variety of sizes, tempers, grades and finishes.

Back of every inch of it is all the skill acquired in 122 years of research, discovery and pioneering—the things which have made Wissco one of the world's leading specialists in wire. The thousands of Wickwire Spencer workmen are breaking all-time records in producing Wissco wire for Victory needs, watching every step as it goes through our blast furnaces, open hearths and wire mills on its way for use in war equipment—and for maintaining our civilian economy.

If you have a wire need, put it up to experts. Wickwire Spencer Steel Company, 500 Fifth Avenue, New York (18); Buffalo, Chicago, Detroit, Philadelphia, San Francisco, Worcester.



FROM A TO Z every step in the manufacture of Wissco wire, from ore pile to finished product, is taken right in our own mills. That's one reason for the *uniformity* for which Wissco wire is famous.

**SEND YOUR WIRE QUESTIONS TO WICKWIRE SPENCER**

**WISSCO**  **WIRE**  
**BY WICKWIRE SPENCER**





## *Courage to Risk and Vision to Foresee...*

The future prospects of The Youngstown Iron Sheet and Tube Company, which had grown from a \$600,000 vision in 1900 to a \$4,000,000 reality by 1905, were so favorable that arrangements for a loan of \$2,500,000 to finance additional expansion were justified. This move occurred five years from the date of the incorporation of the company.

These additional funds made possible the installation of two Bessemer converters, soaking pits, blooming mill, billet mill, sheet bar mill, skelp mill, plate mill, power plant and other necessary auxiliary equipment. It was in 1905, also, that the word "Iron" was deleted from the company name and this organization was known henceforth as The Youngstown Sheet and Tube Company.

The progress shown at the end of 1905 was an indication of the majestic proportions to which this company was to expand in the future. This experience in building from an unpretentious beginning to a position among the leaders in a great American industry is parallel to that of all the great industrial organizations in

America today. It is a manifestation of one of America's greatest heritages -- the inalienable privilege of any individual or group of individuals to do as we have done -- or better.

## **The YOUNGSTOWN** **SHEET AND TUBE COMPANY, Youngstown, Ohio** Manufacturers of **CARBON • ALLOY AND YOLOY STEELS**

Pipe and Tubular Products . . . Sheets . . . Plates . . . Conduit . . . Bars  
Tin Plate . . . Rods . . . Wire . . . Nails . . . Tie Plates and Spikes

# AN *Unrestricted* MATERIAL FOR WIRING WAR WORKERS' HOMES

• Wiring devices of porcelain are the immediate and dependable solution to wiring for war housing. All Government Directives on wiring, including the War Housing Critical List, specify non-metallic or porcelain outlet boxes, wiring devices, etc.

Porcelain has such values as permanency, economy, safety—with it you get liberal adequacy and capacity—being rust and corrosion resistant, maintenance, due to these trouble producers, is eliminated.

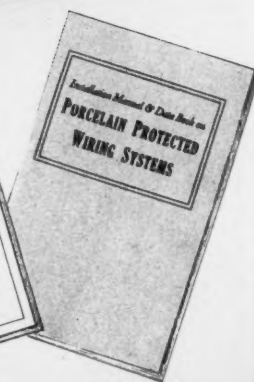
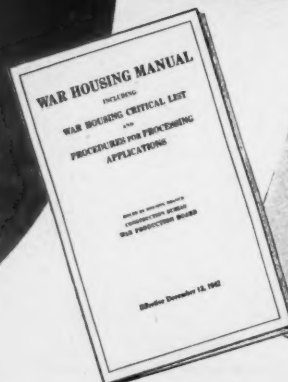
When you use porcelain you save vital materials for war purposes. Installations are made in minimum time.

Ask about shallow porcelain outlet boxes developed to answer the need for the shallow walls of prefabricated housing.

The companies listed below will be glad to cooperate with you.



## *Modern* PORCELAIN PROTECTED WIRING SYSTEMS



### MODERN PORCELAIN PROTECTED WIRING SYSTEMS



★ ILLINOIS ELECTRIC PORCELAIN CO.  
Macomb, Ill.

★ KNOX PORCELAIN CORPORATION  
Knoxville, Tennessee

★ PORCELAIN PRODUCTS, INCORPORATED  
Findlay, Ohio



## Delivering "FRESH FISH" .. gently .. for Axis breakfasts

"On the alert"—men, machines, and torpedoes function smoothly as one team on board this aircraft carrier. From the depths of the ship a fast-moving elevator lifts a load of deadly "tin fish", bringing its platform to a smooth stop within 1/16-inch of the deck. An important 1/16-inch, because it permits torpedoes to roll directly onto the flight deck without dangerous jarring—or extra, time-consuming handling.

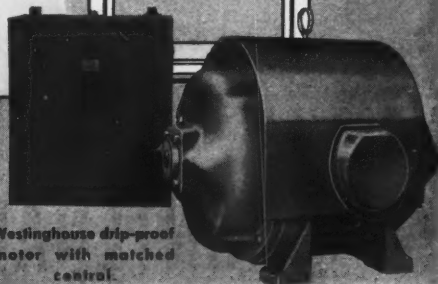
The motor and control which power the elevator work as a team—lifting torpedoes at high speed to the deck and then slowing down gently to a stop "on the nose". To do this, the motor was built with two windings: a high-speed winding for lifting or lowering, and a slow-speed winding for leveling to an accurate stop.

Westinghouse builds many ratings of motors and controls for military and war industry applications. A multitude of these units, like the Westinghouse motor and controls in this elevator, are constructed to withstand the shock and pounding of sea and air battles. For any type of motor, any control . . . on any application . . . call your nearest Westinghouse office.

1-21282



**Westinghouse**  
PLANTS IN 25 CITIES OFFICES EVERYWHERE  
**MOTORS AND CONTROL**



Westinghouse drip-proof motor with matched control.

flight deck



## THE PM PLAN HELPS SIMPLIFY YOUR MOST IMPORTANT WAR JOB

### Industrial Plant Maintenance

With construction cut to a minimum for the duration, maintenance of industrial electrical equipment is the contractor's most important war job. By such a program, he has a direct hand in helping industry maintain continuous wartime production—despite shortages in essential wartime equipment.

Based on an annual maintenance agreement, contractors can offer: regular and systematic inspection and repair; service by specialists on electrical problems; broad experience gained over a period of years, in many plants; up-to-date methods and materials; proper tools and equipment, to do a thorough job.

To aid contractors in this vital activity is Anaconda's aim. With this in view, the Preventive Maintenance Plan was designed. Although introduced only recently, over 11,000 free Plan Manuals have already been sent out on request.

*"Tomorrow may be too late . . . do it today!"*

# ANACONDA'S PREVENTIVE MAINTENANCE PLAN



#### 1 WHAT THE PLAN IS

The PM plan is a simple but comprehensive guide which can help you maintain electric wire and cables in busy war plants and thus help safeguard continuous peak production.

#### 2 HOW IT WORKS

The plan provides a practical means of making a periodic, systematic analysis of circuits and equipment. Uncovers potential weaknesses . . . suggests ways to correct them . . . prevents overloading of lines.

Data thus gathered aids local W.P.B. Branches in reaching decisions on requests for materials to prevent accidents.

NOTE: Your Anaconda Distributor will gladly cooperate in working out the program.

#### 3 HOW THE CONTRACTOR BENEFITS

The PM plan assists in carrying out the all-important maintenance program. Helps keep business going and trained personnel together during construction lull . . . enables contractors to put employees on an annual, rather than hourly, wage rate . . . helps keep old customers, gain new ones, despite lack of products to sell . . . puts electrical contractor in leadership role for furthering the war effort.

If you aren't already utilizing the Anaconda Preventive Maintenance Plan, mail the coupon for full details.

Anaconda Wire & Cable Company  
25 Broadway, New York City

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding wartime production.

Individual .....

Company .....

Address ..... City .....

7F

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# Engineering Design

## —Creator of America's Mechanized Might

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*In war, as well as in peace, the design engineer is the vital link between the inventive mind and the mass-production reality*

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IT is gratifying and interesting to note that reports of new "secret weapons" not only have reversed their course during the past few months . . . they also have increased in frequency. Once they filled us with dread and misgiving. Today the enemy does the worrying.

Word about the latest new Army weapon reached us as this was being written . . . a 2½ ton truck that performs on water as well as on land with equal efficiency. "The Duck", resembling an overgrown amphibious jeep, is particularly suited to landing operations where docks are lacking. Loaded with 20 fully equipped soldiers or their equivalent in supplies, its propeller runs it ashore. It climbs the beach on its six-wheel drive and continues the trip on land.

This important addition to our "second-front" fighting equipment, coming so closely on the heels of the now famous tank-killing "Bazooka", is one of many history making contributions of American design engineers — the men who transform nebulous ideas into practical realities — the men who make our war machines superior to those of our enemies.

Invasion and eventual victory became a certainty as soon as America's design engineers threw their full effort into the war against aggression. Adapting intricate ordnance designs to mass production, these men developed weapons such as the M-10 destroyer of Rommel's tanks and brought out the new fighting planes and bombers that have won the air superiority that has turned the tide against the Axis. Taking ideas and giving them form, selecting the materials of construction, deciding upon the method of fabrication, adapting the electrical and mechanical parts that power the product, specifying the finish that protects and beautifies it . . . these men are the focal point of American production. Their ingenuity has no parallel. Once they put automobiles on a mass production basis and within the reach of all. Today, after less than three years and with little previous experience in armament design,

they have brought America's war weapons to the highest efficiency . . . surpassing Hitler's weapons despite all the vaunted scientific wizardry of the Germans and their ten year start.

At this point it is well to remember that while Germany's military might is traceable to its superiority in armament, many of the basic technological discoveries (including the airplane and the submarine) are the products of American genius. The Germans always have been aware of the military advantages of technological superiority and have forced its expansion with all their might. They knew that mobility and surprise play a decisive role in modern warfare and their design engineers were kept

busy, with unique intensity, to achieve unprecedented results in fast-moving, hard-hitting fighting equipment. Our own military and industrial engineers did not go into action until it became certain that we would be involved in the conflict. But even before our country actually embarked on its Preparedness Program they were busily engaged in developing the designs of our war equipment. Tanks, planes, guns, ships and hundreds of other apparatus and machines of war were studied. Carefully selected committees of our national engineering societies

were organized under the leadership of the Army Ordnance Department to serve as advisors and consultants in the development of advanced designs of tanks and other motorized equipment of war. The above mentioned "Duck" and the now famous Sherman tank are just two of the many results of these efforts.

After the Preparedness Program had officially been launched and Congress had made its initial appropriation, it was necessary to create the manufacturing blueprints from which the engines of war could be built. Because the designs of the machines of production, as well as the designs of the products themselves, determine the speed and economy with which anything can be manufactured,

*This is the thirteenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.*

the capacity of our industrial system is dependent, to a considerable extent, upon the ability and ingenuity of American design engineers. Germany's military might was successfully mechanized because Germany, for more than 10 years preceding the war, was riding the wave of a world-wide technological revolution. This revolution was as far-reaching as the advent of the electric motor and the internal combustion engine. It was born of the profusion of inventions and discoveries since the last war. German design engineers took advantage of every one of these.

If we are to defeat our enemies and if we are to continue to play the leading role in the post-war world we must make better use of the new technology than do our enemies. The job is up to American product engineers who already have made tremendous strides in designing the intricate machinery of production and of war equipment. Much remains to be done however.

It has been said that the Germans have not developed one single item that can be classified as basically original, nor are there indications that any so-called "secret weapon" will henceforth be developed by them. Today the Nazis are completely outclassed by the tremendous manpower of engineering brains that is at the disposal of American industry. Although we were faced by the same fundamental problems of shortages in materials, manpower and time, our engineers not only solved these problems quickly and effectively, but they outstripped the enemy by the preponderant weight of talent which we were able to bring to bear upon our problems. As is evidenced by studies of the designs of captured German war equipment, our airplanes are faster, carry heavier loads, have superior protective armor and heavier armament. Our tanks, especially the Shermans, stand unmatched. Our tractor-mounted artillery excels theirs in fighting power. Our automotive vehicles are the envy of the world. Our battleships are supreme. Our signal and detection devices are frustrating all of our enemies' attempts to dominate the seas.

And as we approach the end of the conflict, the pattern of which already has been set, the forces that converted American industry from peace to war-production will again be brought into play, and the product engineer will continue to be the fulcrum. Our post-war industry will grow from his blueprint. Nor will his job be any less urgent, any less responsible, any less sweeping in its effects than were his efforts during the war-preparedness program.

Since the cessation of the manufacture of peace-time goods, many new materials and production techniques have been developed. Plastics, synthetic rubber and magnesium in the field of materials were relatively new and restricted in their uses when war came. So were powder metallurgy, induction heating, electrostatic heating, adhesives for joining metals and compressed resin-impregnated wood. The new possibilities in product design created by the electronic devices and applications developed during the war period virtually stun the imagination and the "atomic revolution"

promises to change the entire pattern of manufacturing operations.

Never before has there been so much speculation about the future as there is today. Looking forward, who can doubt our limitless capacity to continue our industrial world leadership?

While no one can predict developments in product design in the post-war period, certain it is that they will be so vastly different and so far superior to existing designs that they will obsolete most products as we know them today. With engines of vastly superior metals, designed to burn 100 octane gasoline and built to a precision ten times greater than that of pre-war engines, our post-war automobiles will give from 40 to 60 miles to the gallon. Tires will last from forty to fifty thousand miles. The comfort and smoothness with which these cars of tomorrow will glide along are undreamed of today. Polaroid windshields will eliminate the glare of oncoming headlights and the driver will need to give but scant attention to the manipulation of his simplified gear shifts.

According to no less an authority than Igor Sikorsky, we stand on the threshold of a new air age in which the helicopter will contribute to the greatest prosperity we have ever known.

Prophecies are hard to make at a time like this but speedy house building seems to be a certainty in the world of tomorrow. Air conditioning, new methods of heating, humidifying and drying, promise to be necessities in the post-war home. Vacuum sweepers will be much lighter, less noisy and easier to manipulate. Washing-machines will be fully automatic and practically free of noise and vibration. Not only will our homes and most of the furnishings be of radically new design, but so will the factories and machines that produce them.

Only one factor can prevent the fulfillment of the dream of the product designer. His job is not accomplished over night. To convert sound ideas into production blueprints involves a great deal of time and money. The building of test models is an expensive and tedious procedure. An abundance of seed money is required to perfect the product, to develop mass-production methods and to bring it to fruition as a finished saleable product.

It is the patriotic duty of every industrial leader to hasten these developments so that the material benefits created by them may speed our progress along the road of abundance.



President, McGraw-Hill Publishing Company, Inc.

# Electrical Contracting

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## ATTITUDE TOWARD PLANNING

Military strategists make their campaign plans against a probable time table. Then they allow for contingencies which might upset the schedule. However optimistic they feel about the probabilities of a quick victory, they are set for a long war.

Businessmen have quite a different problem in strategy. For the duration they must operate in the close harness of the necessities of total war. Products and facilities are reduced to the minimums of immediate needs. But they too have a grave planning responsibility. Whatever the probable course of battle, they must be set for a short war. Their postwar plans must be ready. They must have market data, trends, products, sales strategy, promotion and, most of all, jobs ready and waiting.

The electrical construction industry has an especially difficult job to do. Its destiny in the postwar world is complicated by the great lessons of the war. It can no longer gauge its markets and prospects as a statistical segment of the construction industry. Electrical construction and installation, the realm of the electrical contractor, is today vastly greater than a flat percentage of the new brick piles.

It is obvious today that wiring, lighting and apparatus are facilities more closely related to the machine, the process or other uses than to the physical dimensions or cost of the building structure. A great volume of elec-

trical work during this era is entirely unrelated to other construction. There are, in fact, structures which do little more than house elaborate electrical systems and processes; for instance, the making of aluminum.

A far cry indeed from the days when the electric work was a relatively small contract of necessary but incidental importance to the structure. The statistical segment type of thinking is definitely washed up by the sheer progress of electrification. The "sub-contract" attitude is clearly an anachronism. The electric work is important in its own right by virtue of its essential function.

The substantial basis for postwar development in our industry must be drawn by committees with access to full information. Construction statistics are relatively detailed and comprehensive. They are extremely useful for planning the course. What I urge here is an attitude, a state of mind, a mental approach to the many problems which planning committees must solve, and which individuals must consider in looking ahead. In these few war years our industry has progressed further than we know.

*Wm. J. Stuart*

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JULY, 1943



*but a \$1.10 order got it into the air*



**Billion-dollar orders** for aircraft get the headlines, but more than once, a *dollar* order to Graybar for a missing part has been a key factor in getting a plane fully ready for flight.

**One important builder**, for example, rushed five emergency orders for production items to Graybar in a single day. Their amounts? \$1.10, \$15.00, \$5.00, \$1.10 and \$1.10. One covered an all-important set of special fuses. Others were for cable rings, clips, fittings and special lamps.

**In one case**, a special messenger made immediate delivery from stock. In others, telephone calls to St. Louis and Cleveland helped speed delivery. All were "money-

out-of-pocket" orders for Graybar, from the short-range point of view.

**In building today's complex combat equipment**, emergency needs like these are inevitable, no matter how carefully buying is planned. That's why prime contractors whose orders run to billions maintain a close tie with a local Graybar office, with daily or even hourly contact.

**From its nationwide network** of warehouses, from its well-informed relations with more than 200 leading suppliers, Graybar serves as Procurement Advisor on electrical needs, large and small. Why not check up now to see if your company is using Graybar's time-saving services to the full?

Executive Offices:  
**GRAYBAR BUILDING**  
New York, N. Y.

# GraybaR

IN OVER 80 PRINCIPAL CITIES



# POWER for ALUMINUM

The story of the wiring and electrical equipment for one of the largest current carrying systems in the world—the silver buses in the New York plant of Alcoa—DPC.

By Robert E. Miller, *Industrial Editor*

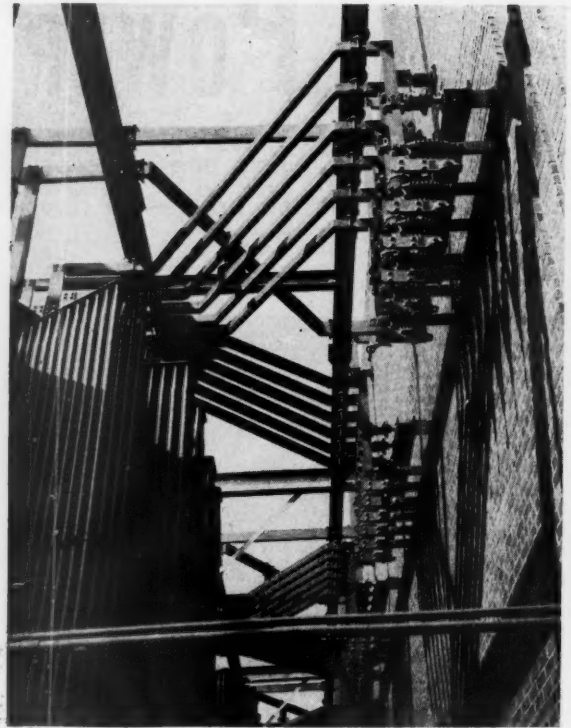
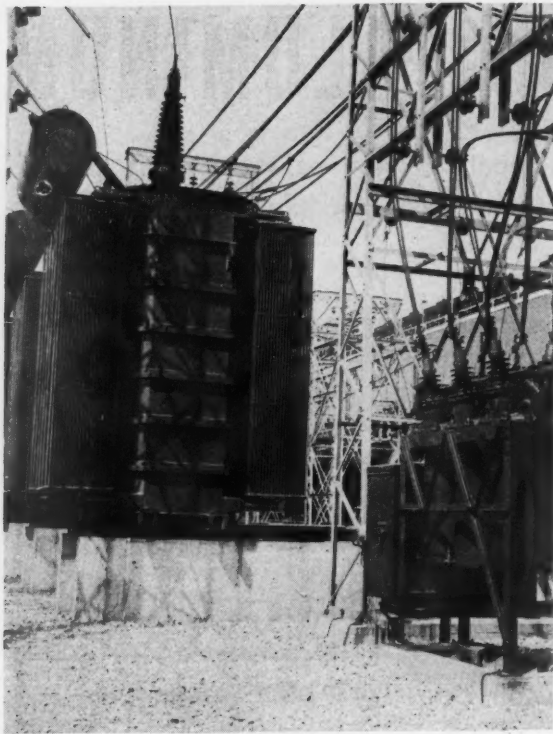


**R**ANKING among the largest power consuming industrial plants in the world, the Aluminum Company of America, Defense Plant Corporation, reduction plant in New York City, is now turning out aluminum pigs to meet heavy war requirements. P. T. Coffin, Works Manager, in charge of operations, takes over each pot line for production purposes as they are completed. F. B. Hastings, construction superintendent, and L. W. Coddling, in charge of electrical construction coordinated all construction efforts to get into actual production as quickly as possible. The huge electrical job offered many problems of exceptional interest. Treasury silver for bus bars, critical materials conservation, and construction scheduling to permit production in advance of total completion were among the unusual factors in

the job program. The major portion of the electrical contract was held by Lord Electric Company, while other portions were held by Hatzel and Buehler and Goodrich Electrical Installation Company.

Due to critical copper and aluminum supply, the bus bars to carry the extremely large currents required for aluminum reduction were manufactured from silver. The United States Treasury consented to its use and deputized guards, whose entire responsibility is the safety of this Treasury silver, are stationed throughout the plant. The bars were rolled, cut and punched to specifications before shipment to the plant. No bar could be drilled, tapped or reamed during assembly. All buses were directly connected by bolts or cast iron clamps. No soldering or brazing operations were permitted on the silver bus.

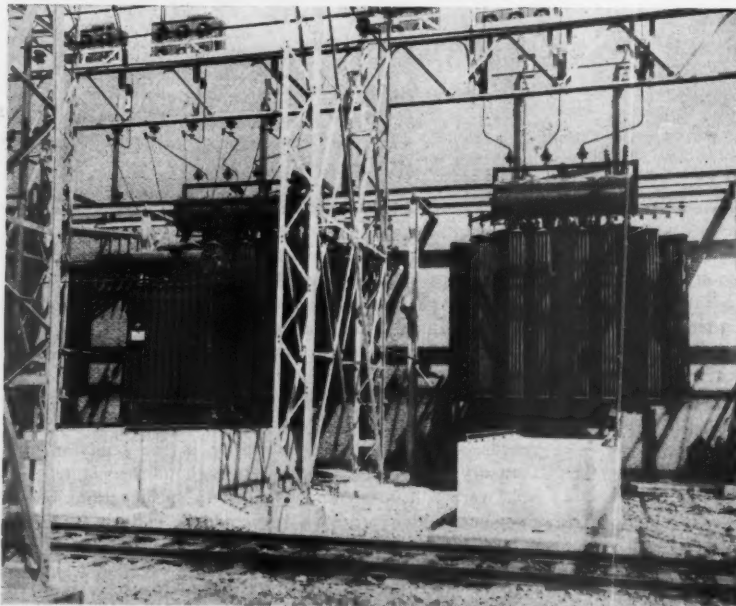
## POWER FOR ALUMINUM (Continued)

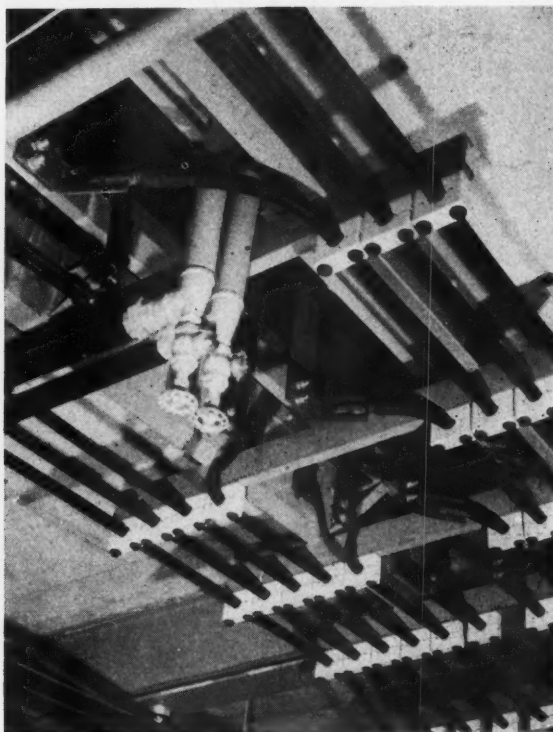
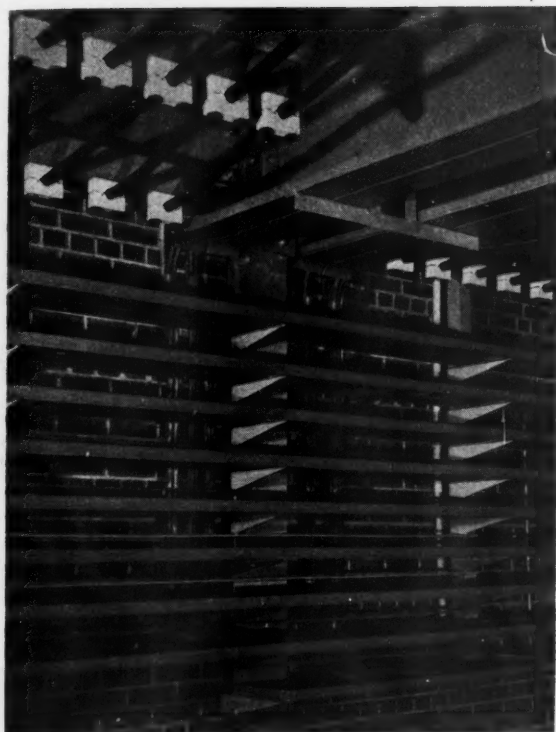


POWER EQUIPMENT from incoming service to the rectifier is outdoor type. Installed capacity runs well into the hundreds of thousands of kva. Power transformers in single phase units are assembled into 3 phase banks for transforming the power from 138,000 volts to 13.8 kv. Each three phase power bank supplies a unit of rectifier transformers. An oil circuit breaker is provided between

the power bank and the 13.8 kv. bus from which the rectifier transformers are fed through disconnects. Each rectifier transformer is a three phase unit of the three-winding type, providing double six-phase power to two twelve-tank rectifier units. A 36 phase operation is obtained in the following manner. First, a straight delta-wye transformation gives six phase voltages 60 deg. apart. Next, a straight wye-wye gives six additional phase voltages 60 deg. apart but displaced 30 deg. from the straight delta-wye voltages. The other four rectifier transformers are each equipped with a 10 deg. phase-shifting transformer, two 10 deg. leading and two 10 deg. lagging. Then with a 10 deg. lead and a 10 deg. lag on the delta-wye transformation; and a 10 deg. lead and a 10 deg. lag on the wye-wye transformation, a total of 36 phase voltages in all are obtained 10 deg. apart. This not only reduces telephone interfering harmonics on the primary transmission lines but also gives a smoother d.c. operating current.

Copper channel bus is used for the secondary lead-ins to insure sufficient strength against the stresses set up by the heavy currents entailed with arc-backs. The 12 channel buses fan out from each transformer to form a Y, six channels to the right to feed one bank of rectifiers; six to the left to feed the next bank.

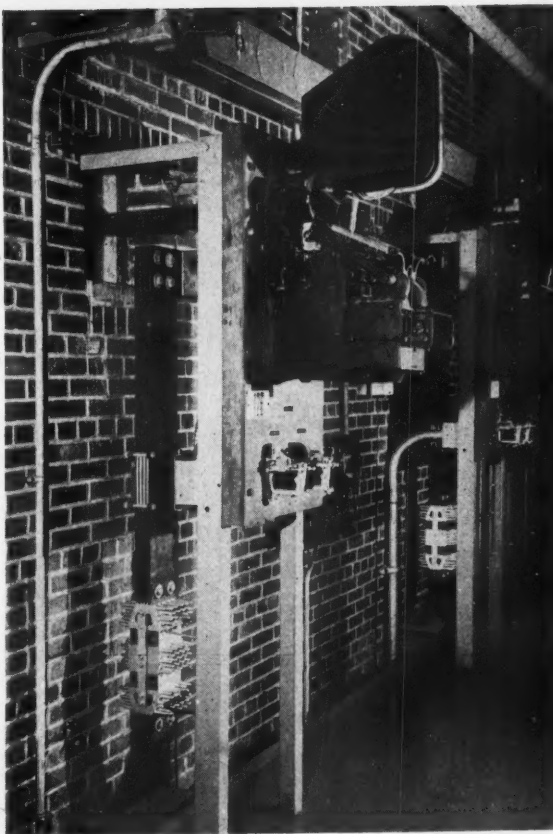




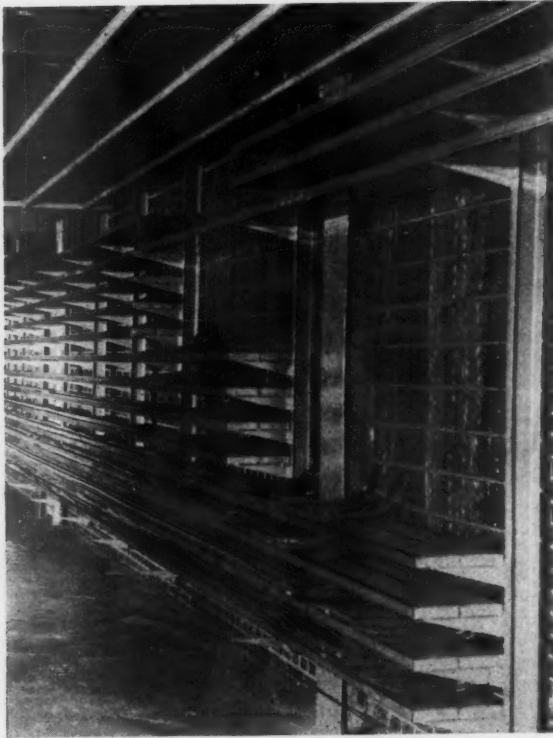
THE BUS LEADS into the building through small square openings, which have since been plugged with insulating block for black-out operation. A six-pole anode breaker utilizes a balance reactor on each pole to split the phase current equally to two adjacent tanks in the 12 tank rectifier unit.

The rectifier room floor is suspended at the columns, leaving an open space of 8 inches between wall and floor from column to column. In this way, cables, conduits, piping, etc. can be dropped to the basement, run to the proper point and brought back up without having to drill the floor.

Thus the 12—800,000 cm cables leaving the balance reactors connected to the six-pole anode breaker, which is mounted on the west wall, drop to the basement where they are carried over to the rectifier on ceiling brackets with porcelain cleats. The cable is brazed directly to a flat copper terminal of the same dimensions as the anode bus which leads up through a rectangular opening over which the rectifier is mounted on 7500-volt bell insulator feet. The rectifier chassis is at a constant potential of 650 volts. The arc from the anode is initiated by an igniter and plays on the mercury pool in the bottom of the tanks. The tanks, which are therefore the cathodes, are all connected by one run of copper bus that is suspended from the basement ceiling and emerges up into the rectifier room between wall and floor. A shunt is provided in the bus just ahead of the single pole cathode breaker which is mounted on the east wall. The copper bus is taken out through another small square opening in the wall (also plugged with insulating block) and is connected to the positive main bus which runs on the outside the full length of the rectifier building. The negative connection comes directly through the building from the midpoint of each interphase winding.

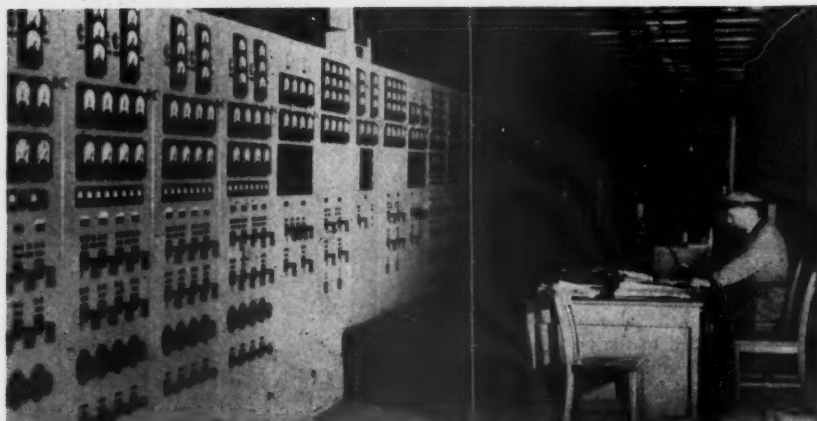
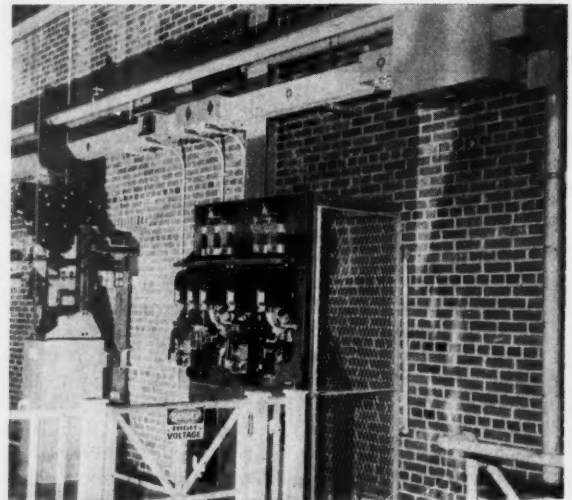


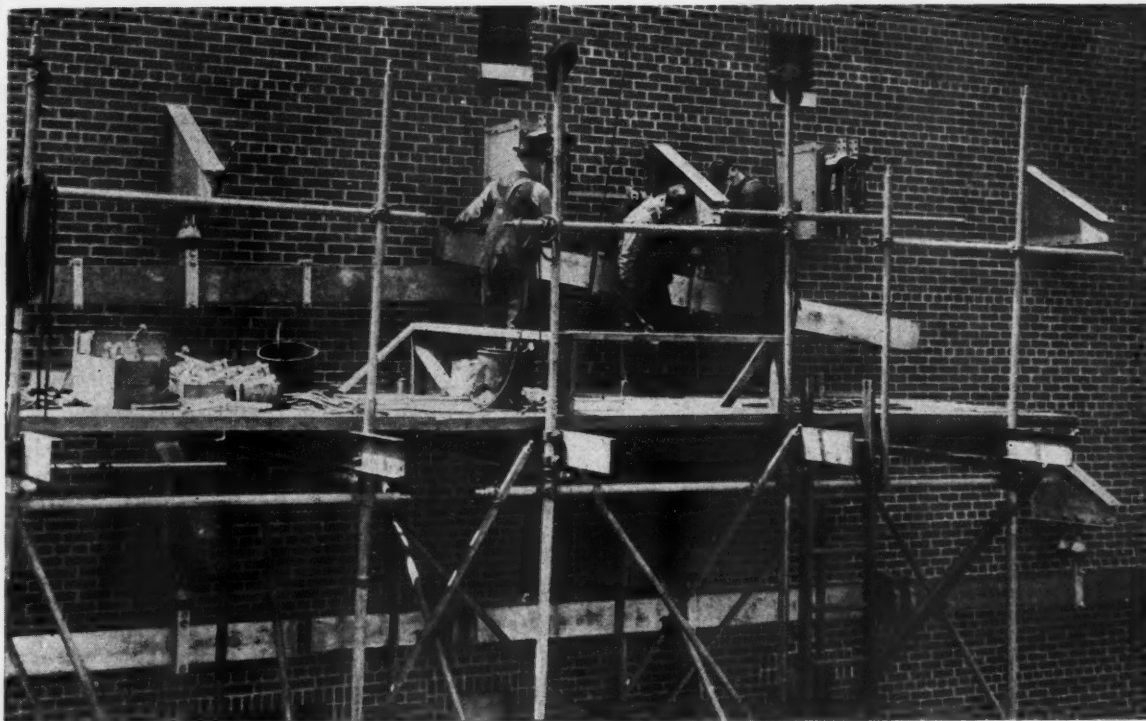
## POWER FOR ALUMINUM (Continued)



THE CONTROL CUBICLE sets at the end of each rectifier unit. It is this control which energizes the igniter at the proper instant for initiating the arc. The retarding or advancing of the firing instant provides voltage regulation under manual control by the operator at the main control board. The control cable from each unit is brought to the wall by trays hung from the basement ceiling. Here it is dropped into one of a bank of trays, all carrying control cables into the central control panel. At first, the longitudinal trays were supported from the floor with a ladder type construction, but the inside vertical supports necessitated "threading" the cable into the trays. Since this required the expenditure of a lot of unnecessary time and labor, the trays were suspended from the ceiling at the back, eliminating the inside vertical support so that now the whole length of cable can be thrown into or taken out of the tray very easily.

Auxiliary 440-volt power is brought into the basement and up to the rectifier floor in four inch conduit. Bus duct is run the complete length of the building and is attached to the building columns above the cathode breakers. General lighting is supplied from 460-volt/115-volt transformers, for two lamp fluorescent fixtures using 100-watt tubes. Mounting height is 21 feet, and three rows 8 feet apart are run with a center spacing of  $12\frac{1}{2}$  feet. Eye-level intensity is maintained at 20 foot-candles.



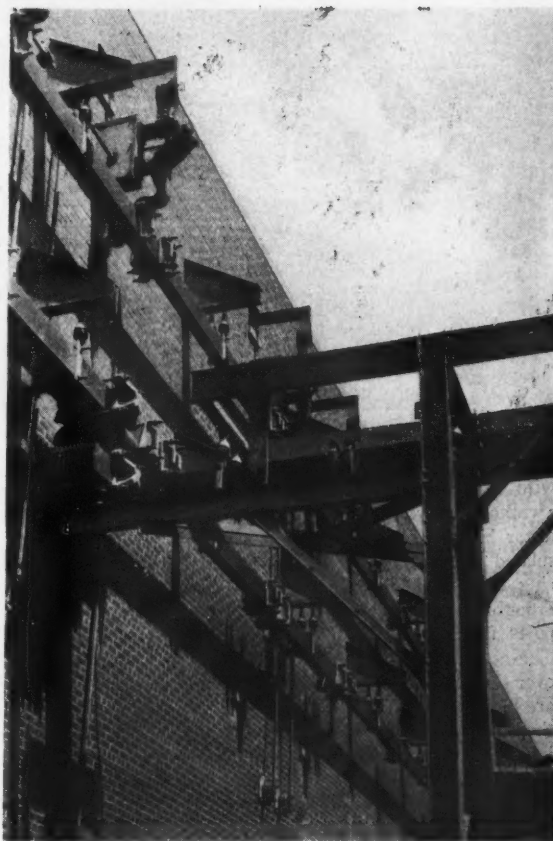


DISTRIBUTION of the heavy direct currents to the pot-lines is made by silver bus  $\frac{3}{4}$  inch by 9 inches. The bus is suspended on the outside of the rectifier building by porcelain insulators from triangular steel supports. In hanging the bus on the building wall, the sections are pre-assembled and lifted into place by crane, while workmen are supported by rolling steel scaffolds.

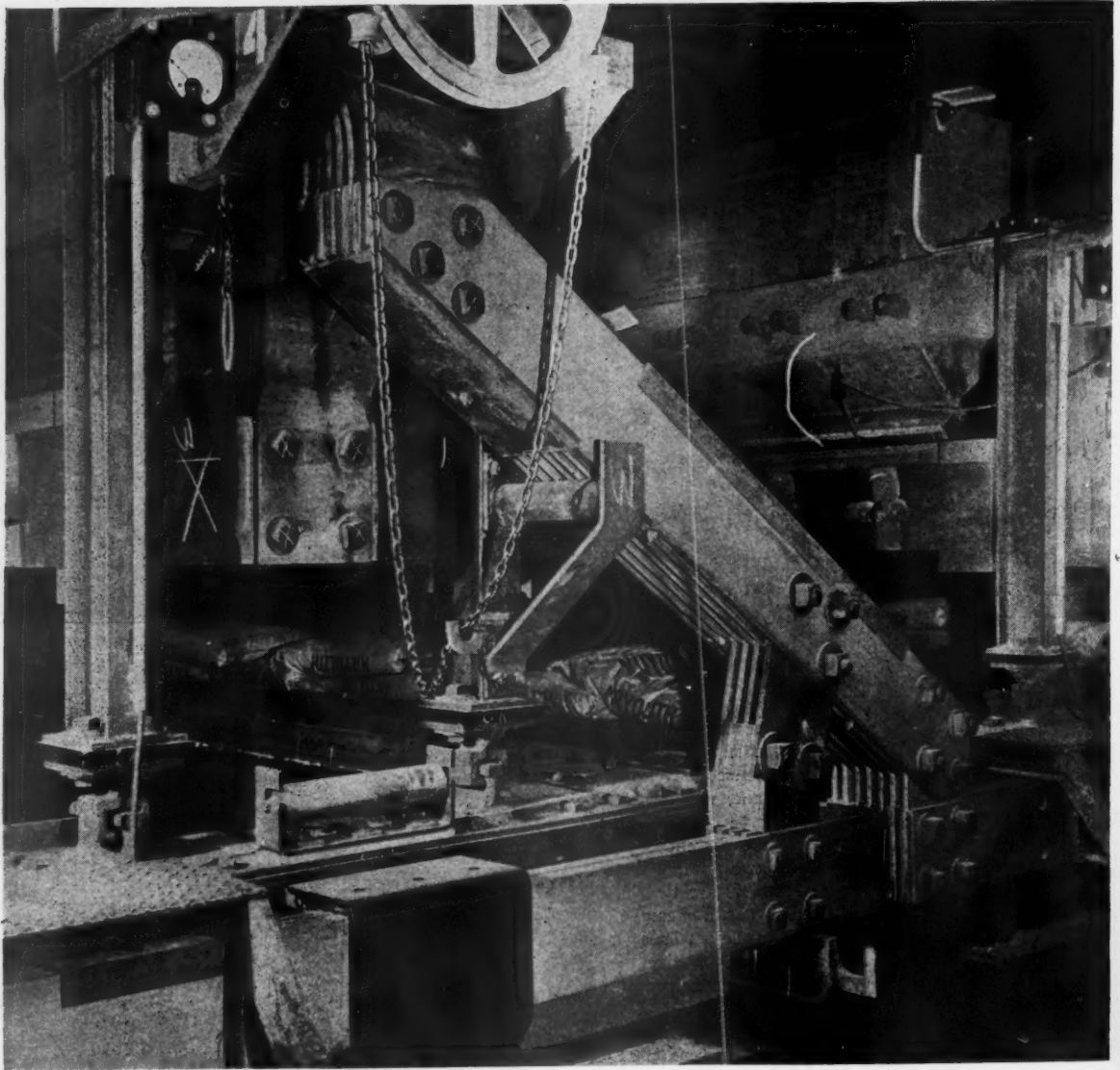
At the end of the building where the current is picked up from the first two rectifier units, two parallel sections of silver bus are used. As more rectifiers are tied in, the cross section of the bus run increases (i.e. a greater number of bars) up to the take-off point to the pot-lines where maximum cross section is required. The positive run is then bridged by steel supporting structure across to the pot-line building where the bus enters through a brick chimney. Before the bus continues on down under floor and to the first pot ring, it is first passed through a copper shunt located in the chimney section. The shunt is used for measurement and control purposes.

The current is carried down through one series of pots and brought back up through another, the two constituting one pot-line. The negative bus is then brought up a chimney similar to the one by which the positive bus entered the pot room. It likewise is bridged across, by steel supporting structure, to the negative bus on the rectifier building, narrowing down to two sections at the end where the last tap takes off through the building to the midpoint of the interphase winding completing the direct current circuit.

The disconnects for the negative bus coming from the rectifier transformers are located just ahead of the taps onto the main bus. They are located on the outside of the rectifier building and hang directly above the negative bus. Flexible copper shunts are used for jumping from the main bus run (parallel to the building) to the disconnects and also to the bus which is bridged to the pot line buildings.



## POWER FOR ALUMINUM (continued)



EACH POT IS FABRICATED of steel and is first lined with insulating material. A lining of carbon mixture acts as a cathode in which is buried round steel bars. These collector bars are brought out through the tank shell uninsulated and by copper straps are connected to the silver ring bus. The ring bus is pre-assembled on tables and brought to the pot by truck. The ring rests on steel supports fastened to the pot shell and uninsulated from it. The anode bus is a straight section supported lengthwise over the center of the pot. From it hang the anodes, which are large cubes of carbon on the end of a copper bar. The copper bar is clamped to the anode bus and can be adjusted individually for height. After individual adjustments are made, the anodes are gang operated by a wheel and chain. As the anodes burn away, they are continually adjusted downward, until the carbon block is almost completely gone, at which time they are replaced.

All pots in each line are connected in series with approximately  $4\frac{1}{2}$  volts drop across each one; all carry the same normal current of about 50,000 amperes.

The positive bus comes under floor from the chimney and is connected to the anode bus at each end. Current leaves the anode blocks, through the cryolite bath, enters the cathode and is carried to the silver ring cathode bus. At the two far corners of the ring bus, connecting sections carry the current on to either end of the anode bus of the next pot and so on through the entire line.

Each pot has its individual voltmeter, scaled to ten volts, for indicating the voltage drop across that pot. By this means, correct operation of the pot can be obtained.

A solid copper wedge may be driven by sledge between the cathode ring bus and the diagonal riser to the anode bus. In this way any number of pots can be shunted during the initial baking-out period of a "green line."

**FIVE ASSEMBLY TABLES** are provided for the assembly of the ring bus. Other tables are used for the assembly of various silver and copper bus connecting structures. On long tables, specially built, copper connecting straps are laid one after another, to enable mass surface polishing with electrically driven sanding discs. A silver bus bending machine with a number of templates is provided for making the various required bus bends, all of which are right angle. Wherever the silver bus is handled, the operation is under continuous guard.

All copper is processed in the copper shop. A punch press was purchased and adapted for all punching operations. All holes are punched rather than drilled. A copper buzz saw was rigged up from a few pieces of angle iron and a motor, to supplement a purchased unit when a second new unit was found to be unobtainable. Several bending machines are employed to bend the various buses into the desired shapes. A job laid out on the floor is used for fabricating the secondary copper channel leads from the rectifier transformer. Various kinds and sizes of electrically driven emery cloth and wheel polishers are used for removing copper oxide coating from the surfaces. Other jigs, templates and special tools are used for speeding the bus installation.

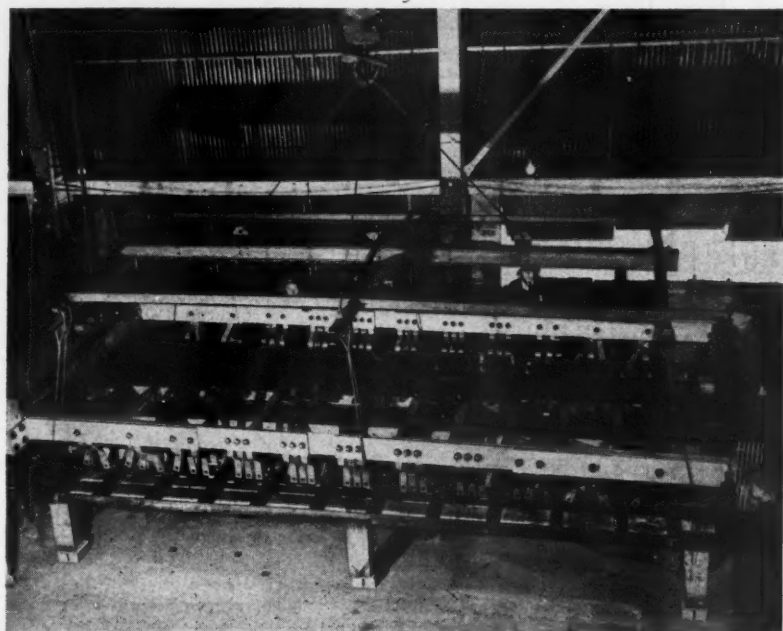
Small substations are spotted throughout the property to supply power for lighting, cranes, furnaces and other plant electrical equipment. Three-phase units supplied



from the 13.8 kv. bus transforms power to 440 volts for utilization. At several points electric melting furnaces are used in the operations and a separate bank of transformers are required to reduce the voltage to 4000 volts. Additional auto-transformers at the furnace with automatic tap changing under load equipment reduces and regulates the furnace voltage over the range of 75 to 125 volts as required.

Lighting transformers in each building cut the 440 volt current to 115 volts for lighting circuits. Both straight incandescent, and staggered 500-watt incandescent and 400 watt high bay mercury are used for general illumination except in the rectifier buildings where fluorescent is used. Fixtures are mounted at a height of 25 feet, two rows to a bay. Rows are spaced 19 feet apart and hang on 19 foot centers. Messenger cable is run the entire length of each building. The cable is supported every 19 feet on the building structure. Lighting circuits are run with open wiring throughout. Porcelain insulators which carry the circuits are strung from the messenger cable.

The fact that such a huge block of metropolitan power is being diverted to electro-chemical production makes the installation one of more than ordinary interest; and the use of silver adds glamour. The use of silver and "duration" wiring presents a postwar problem of some proportion.

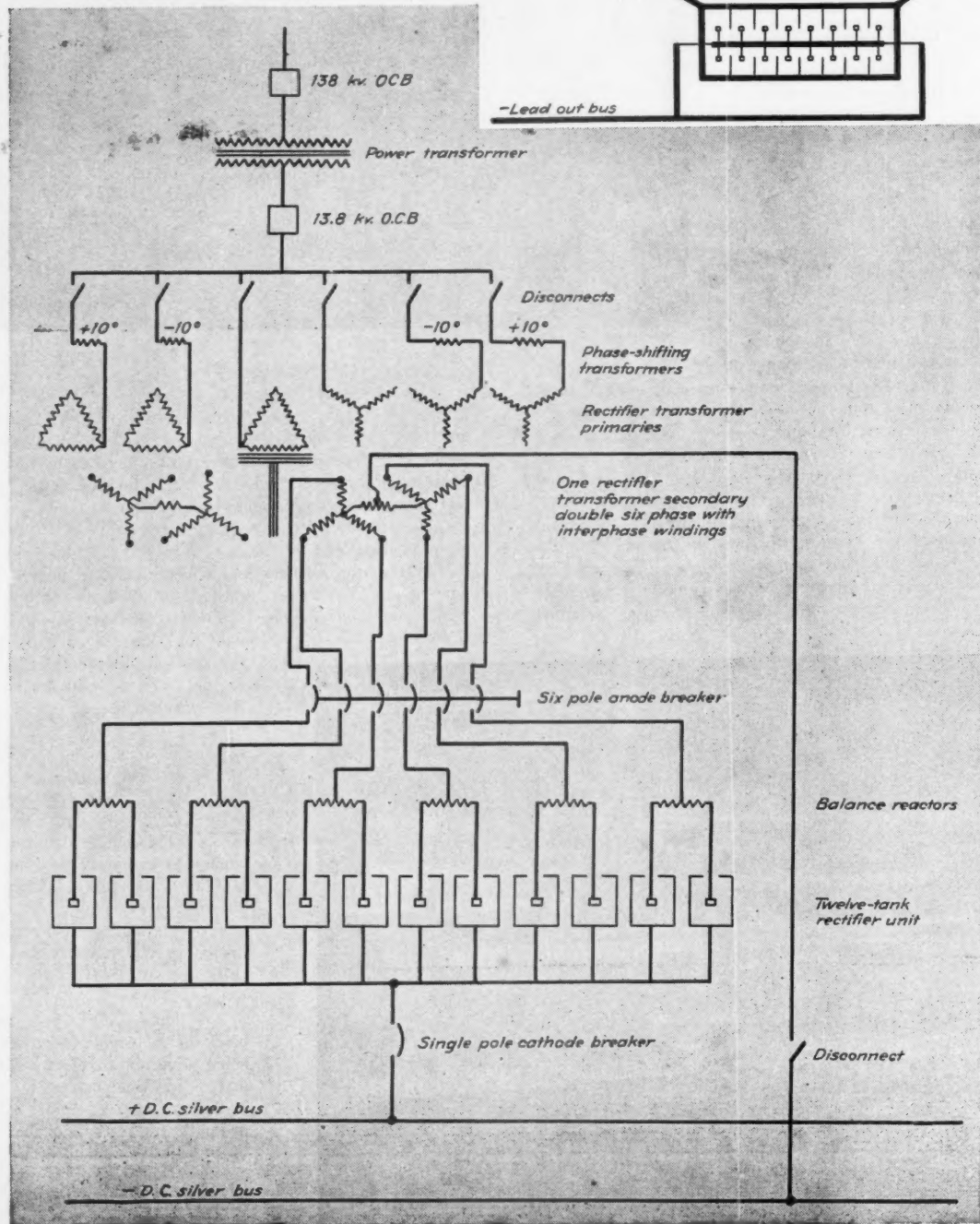


## POWER FOR ALUMINUM

(continued)

SCHEMATIC DIAGRAM of pot line bus work showing positive lead-in, negative lead-out, pot ring and anode silver bus. (right)

SCHEMATIC DIAGRAM showing connections from the 138,000 volt incoming transmission lines to the 650 volt direct current pot line bus. One complete secondary winding of rectifier transformer is shown. Connections to the other secondary windings are identical to the first, each feeding one twelve tank rectifier unit. (below)



# How to Maintain ELECTRONIC CONTROL

A discussion of the highlights of trouble shooting and good maintenance practice for electronic controls in general.

By W. D. Cockrell, *Engineer*

*Electronics Section  
Industrial Control Division  
General Electric Co.*

**E**LECTRONIC control devices—ranging from specialized resistance welding controls used in metal-working industries to standard photoelectric relays (electric eyes) used for hundreds of jobs in all industries—are being worked hard in today's production battle. Electronic equipment, generally, requires less maintenance than other electric equipment since it has no moving or wearing parts. Nevertheless, to keep it in top-notch operating condition and to prevent production interruptions, it is essential that certain maintenance procedures and checks be followed and that troubles be located and remedied as quickly as possible.

Most of the components of electronic controls—resistors, reactors, transformers, and capacitors—are of a semipermanent nature and are conservatively rated to give many years of service with very little maintenance. Even the electron tubes themselves, while replaceable, require inspection and test only at comparatively long intervals.

Although electronic control sometimes will continue to function under extreme conditions of moisture, temperature, and dirt, there is frequently a tendency to neglect the simple rules of good maintenance. Many parts of electronic controls are similar to those used in magnetic controls. Enclosing cases, bases, terminals, and wiring and conduit devices are frequently identical. Standard magnetic control devices—such as fuses, switches, and overload relays of both the instantaneous and the time-delay types, are found on many electronic panels, usually performing starting or protec-

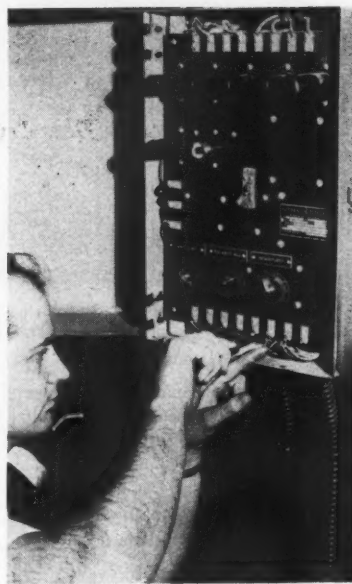
tive functions and operating infrequently. As in the case of standard magnetic control panels, this infrequent operation itself sometimes results in special maintenance problems. Detailed instructions on the inspection and maintenance of these standard devices are found in maintenance manuals covering this equipment.

## Preventive Maintenance

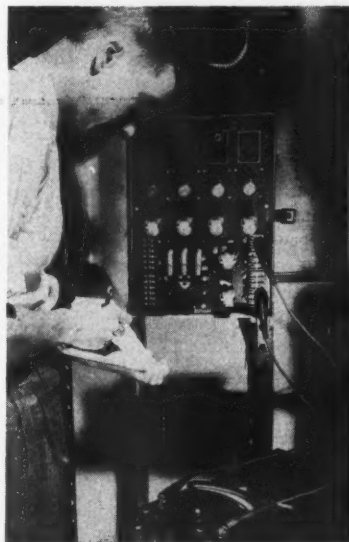
Particular emphasis should be placed on inspection for cleanliness and the effects of vibration. Because of the high impedances used in some electronic circuits, an excessive accumulation of dust or processed material will, particularly when damp, provide parasite circuits which may interfere with proper operation. Lenses and other parts of optical systems should be wiped off frequently with a clean, soft rag.

**LOOSE CONNECTIONS** — Since many electronic panels are interconnected extensively with other apparatus, loose connections or the broken leads through vibration may cause serious shutdowns, entailing intensive (and sometimes aggravating) "trouble shooting" before the fault is located. Vibration also tends to shorten tube life. If severe vibration is found to exist at the installation location, shock mounting of the control panels, as well as the use of stranded or extra-flexible leads, may be justified.

**MECHANICAL ADJUSTMENTS**—Photoelectric and other electronic con-



TERMINAL CONTACTS should be checked regularly to tighten contacts loosened by vibration.



VOLTAGE CHECKS are important to determine if electronic equipment is operating at panel nameplate rating. A 5 percent variation is permissible.



TEST TUBES regularly to weed out and replace defective one. If possible, a spare set of tubes should be kept on hand.

trols involving mechanical components should be checked frequently to assure that the mechanical adjustments have not been disturbed. Common causes of such disturbances are bolts loosening under vibration or chain hoists and other shop equipment hitting against the equipment.

**TUBE FAILURE**—Modern electronic tubes rarely fail suddenly. Failure usually follows the gradual loss of emission that takes place as the active cathode material is used up or flakes off. Overloading, mechanical abuse, operation at high or low filament or cathode heater voltage, and operation outside of required temperature limits all tend to shorten tube life.

**LINE VOLTAGE**—Among the most prevalent causes of poor operation and short tube life are the operation of electronic panels on line voltages differing too greatly from the panel nameplate voltage, and the use of the wrong tap when a tapped-input transformer is provided. Panels are usually designed to operate satisfactorily on line voltages varying plus or minus five per cent of the panel rating. If the voltage at the installation point is consistently high or low, a small auto- or booster-transformer may be used. If the line voltage fluctuates widely, a special voltage-regulating transformer may be required. Faulty heater transformers, loose or corroded socket connections may limit the low-voltage, high-current power required for tube cathode heater.

**TEMPERATURE RANGE**—High-vacuum tubes and tubes filled with true gases, such as argon and xenon, may be operated without difficulty over a wide ambient temperature range. Tubes using mercury vapor operate best in a more restricted ambient range. Enclosing case ventilation and other temperature-regulating means are provided for the usual industrial indoor ambient temperatures of 60 deg. to 100 deg. F. For low ambient temperatures, manually or thermostatically controlled strip heaters may be mounted in the case. For temperatures from 100 deg. to 120 deg. F., fan or forced-air cooling may be sufficient. Above this temperature, components other than the tubes may be affected also and it may be that standard equipment will be unsuitable for the installation.

**HEATING PERIOD**—Panels which use gas- or mercury-filled tubes are normally equipped with a cathode protective timer. This timer should be set for the heating period designated by the instructions accompanying each new tube. This time has been found by experience to be the minimum time permissible for reasonable tube life and must not be decreased for any reason.

**DISTILL TUBE MERCURY**—During the shipment or handling of mercury-vapor-type tubes, the liquid mercury may be splashed on the elements. Therefore, when the tube is first placed in service, it is necessary to heat the tube cathode for a time with the



CLEAN LENSES of photoelectric optical equipment periodically. A clean soft rag is all that is necessary to use for the cleaning.

anode lead disconnected, distilling off the splashed mercury before the anode power is applied. This requires a longer period than the usual cathode heating time; the tube instructions give the proper time.

**EXTERNAL LOADS**—Some electronic panels are designed to use tubes on external loads. These loads should not be greater than either the average or peak rating of the tubes. Sometimes an operator will increase the anode voltage, replace coils, or alter motor pulleys or gearing to obtain a greater output, thus overloading the tubes. Such practices seriously reduce tube life, and should be avoided.

**HANDLING TUBES**—Shocks and jars in handling tubes, particularly when they are old, can be quite detrimental. Sharp shocks, such as caused by dropping or striking the tube, if they do not actually rupture the envelope, may jar the elements out of position or even break welds or leads.

Mercury-vapor tubes must be kept upright as much as possible to keep the mercury off the elements.

#### Trouble-Shooting

The best trouble-shooting tool is a clear knowledge of the operation of the panel and each part of it. If partial operation is obtained but other actions fail to occur, the trouble may be isolated to a part of the circuit.



WAVE SHAPES of electronic equipment should be checked when searching for faults. A cathode-ray oscilloscope tells a complete story.



EQUIPMENT GUARDS protect electronic devices from mechanical injury. Here a metal guard (arrow) protects scanning head from chain hoist.

**METER TESTS**—Since many circuits on electronic panels have a very high impedance, meters having high impedances are very desirable in servicing the equipment. A useful tool is the radio service multimeter which has a resistance of 1000 ohms per volt or higher. For some circuits, however, an electronic meter, such as a vacuum-tube voltmeter of the d.c. reading type or a cathode-ray oscilloscope, is essential.

The cathode-ray oscilloscope, particularly when modified to read direct-current potentials, is an extremely useful device since it combines a very high impedance voltmeter with a time axis, thus making visible voltage changes much too rapid for the ordinary meter to follow. Instantaneous thyatron grid and plate potentials and other voltage waveforms may be observed easily on the oscilloscope and any incorrect operation quickly detected.

In trouble-shooting on electronic control, one should first make sure that the trouble lies in the electronic equipment. Is power available at the control panel terminals? Can the motor or other device be operated by alternate means (such as from a d.c. bus by drum switch or magnetic control) if provided? Are all protective devices and interlocks outside of the panel operating properly? Has the cathode protective timer relay completed its timing cycle and applied anode power? Have mechanical adjustments been disturbed where items such as scanning heads or other mechanical components are used?

The times at which the failure occurs may be divided roughly into three: (1) when first starting a new equipment; (2) when starting after a normal shutdown; and (3) during operation. Trouble shooting hints for each condition follows.

#### **New Equipment Fails to Start**

When new electronic equipment fails to start, the cause may be a lack of correct power, incorrect or missing connections, tubes in wrong sockets, use of wrong or defective tubes, no fuses or wrong size fuse, or damage to panel leads or parts during shipment.

Incoming power should be checked against panel nameplate. The remedy for no power, missing wires, and fuses is obvious. The position and type of tubes can be checked by referring to the wiring diagram and the panel stamping. Defective tubes and (sometimes) tubes in the wrong socket may not heat up. The glow of the hot cathode may usually be seen in glass tubes; in metal tubes the envelope becomes hot to the touch. Caution—(The envelope of metal thyratrons and ignitrons is at cathode potential. Do not touch while power is on the panel.)

Failure caused by breakage of leads or parts on panel is covered below.

#### **Failure to Operate After Shutdown**

When electronic equipment does not operate after a normal shutdown, first check power, interlocks, and safety switches. The cathode heating timer

relay may have failed or the anode contactor may be defective. An old tube often fails due to expansion and contraction as power is switched OFF or ON. Filament or heater burnouts may be detected quickly by inspecting glass tubes or by feeling metal tubes for heating. Power should be removed before touching metal thyratrons and ignitrons. Sometimes an overloaded transformer or reactor will fail due to the expansion cycle as power is removed and applied. Here, however, warning of failure is usually given by excessive heating, the odor of the hot material, melting of the sealing compound, or smoking of the insulating paper.

#### **Failure During Operation**

If, after a period of satisfactory operation, the equipment's operation quickly becomes unsatisfactory or ceases altogether it is often possible to isolate the trouble to a specific cause by noting the exact symptoms of the failure. Power failure or a blown fuse result in an instantaneous change in the equipment's operation. An overloaded transformer, resistor, or wire is usually indicated by heat and smoke before total failure occurs. The cause of overload—whether short-circuit, load coil burnout, or motor-bearing failure—must be found and corrected before the equipment is again placed in service.

A failure in a tube cathode circuit permits the cathode to cool gradually over a period of seconds or even minutes.

[Continued on page 107]

# COLOR CODING

Dabs of paint identify circuits, panels and phases for quick tracing and balancing.

**C**OLOR coding has proven a convenient method for quick and certain tracing in a maze of conduits and circuits. Hammarlund Manufacturing Company in New York City used it extensively in the rewiring required for their recent expansion program. Paul Katz, electrical foreman, introduced a system of coding which facilitates maintenance work and assures balancing of three phase load in the initial installation.

In shooting trouble on plant motors or equipment, if the electrician cannot find the trouble in the connections, switch box or fuses, he can identify immediately by two dabs of paint on the switch box where to pick up the trail. The first color designates which distribution panel feeds the equipment, and the second color indicates the specific circuit to which one load is connected.

Further, each phase wire is identified throughout the entire system by dabbing at every fuse in distribution panels and switch boxes the basic colors, yellow—black—red. It should be made clear that black covered wire is used throughout. The color coding is a hand job of dabs with brush and paint can.

The small amount of time required to do this little identification job has been made up many times over by the time saved in testing and tracing out circuits.

This color coding has been extended somewhat in their lighting system circuits to include the sub-feed panels where each group of six fluorescent fixtures are fused. Phase coding of yellow—black—red, of course, extends throughout the lighting system as in the power system. One main distribution panel feeds all the sub-feed panels, and each of the ten three phase circuits leaving the main panel are identified with the sub-panels by corresponding colors dabbed behind the fuses and on the sub-panel cover respectively as shown in the

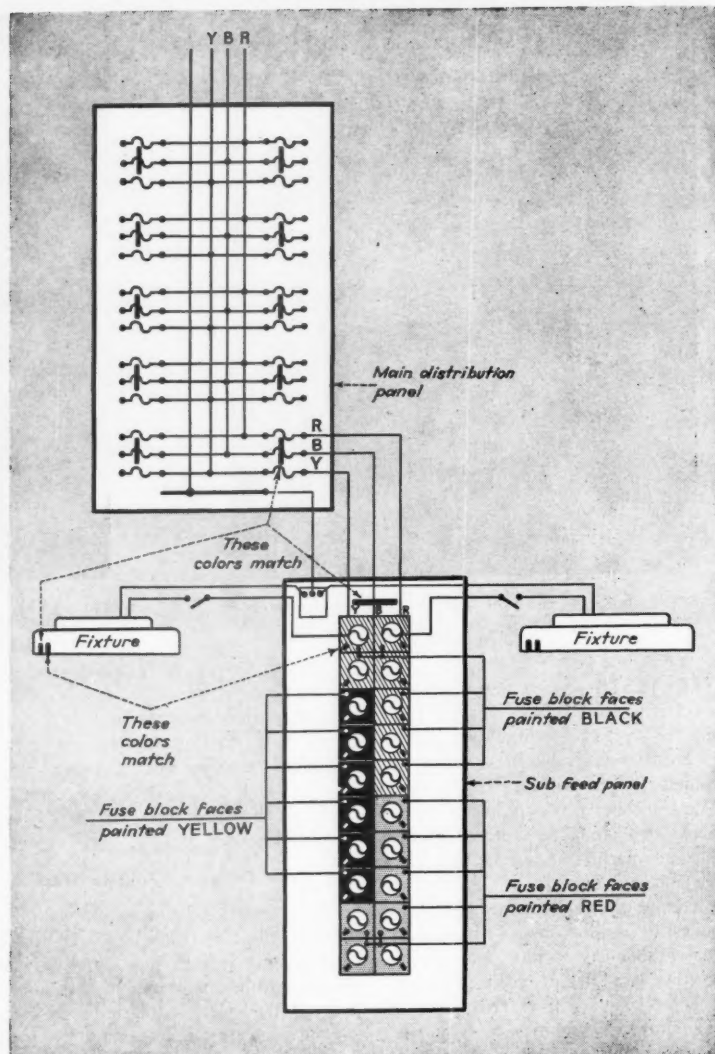


DIAGRAM OF COLOR CODING system used to trace circuits and to balance phases on the initial installation. Black covered wire is used throughout and coding is done with a brush and a few cans of paint.

accompanying illustration. Each sub-panel has 20 fuse blocks which are divided into groups of six—seven—seven. The faces of each group of blocks are painted to correspond with the three phases—yellow, black or red. Further, a small dab of paint of a different color on each block identifies that particular fuse with a group of six fixtures.

This may sound a little complicated but in reality is very simple. For instance, if a group of six lights go out, the electrician checks the two little dabs of paint on the fixture, green and white. The green dab tells him to go to the sub-panel marked with green on the cover; the white tells him which of the 20 fuses protect that group of six fixtures. If the fuse in the fuse block marked with a white dab of paint is

found o.k., he checks the phase to which the block is attached and finds it to be red. (The full face of that block is painted red.) He then proceeds to the main distribution panel, and finds the three phase circuit marked green (behind the cartridge fuses) and the phase marked red (on the copper lug leading from the fuse). He first checks the fuse and finds it good but an inspection of the red lug reveals a loose connection. Tightening the screw puts the lights back on and it was all done in just a very few minutes. No tracing to find the feeding sub-panel. No checking 20 fuses and connections in the sub-panel. No checking 30 fuses and connections in the main distribution panel. This improvised color coding told him immediately where to find the trouble.

# CALCULATING STARTING RESISTORS

**T**HE frequent necessity of adapting existing apparatus to new applications presents problems of design on the job. A common situation is that of reusing or rebuilding resistors for starting and control of wound rotor motors. The following review of standard design practices will provide useful data for tackling these jobs.

Manufacturers of motor control equipment have built up standard slip ring motor speed controllers for speed control down to 50 percent synchronous speed and for starting under various duty cycles. Speed control below 50 percent may be obtained on special order. In addition to the motor nameplate data for speed control, the control manufacturer will require the speed-torque characteristics of the load, the number of control points desired and the speed at the respective points. Standard equipment is broadly classified for fan or machine service depending on whether the load has variable or constant torque. For starting duty, the manufacturer will require the maximum permissible inrush current in percent of full load current, the speed torque characteristics of the load, the  $WR^2$  of the load, and the frequency of starting. Standard starters have the following number of resistance steps for average requirements:

Motor Horsepower	Number of Resistance Steps
Up to 15	1
20 to 40	2
50 to 75	3
100 to 150	4
175 to 300	5

The accompanying table gives duty classification numbers of resistors for various starting and running conditions.

As an example, a Class 155 resistor is designed to carry 150 percent rated current 15 seconds out of 60 seconds. If used in a starter for a motor drawing 150 percent full load current on starting and requiring five seconds to come up to speed, three starts could be made every 60 seconds and be within the resistor rating.

In order to design the resistance to be used for acceleration or speed regu-

RESISTOR CLASSIFICATIONS							
Service Period in Seconds	Maximum Service in Seconds	American Standards Resistor Classification Numbers for Various Approximate Percentages of Normal Full Load Current on First Point					
		25	50	70	100	150	200
Continuous	.....	91	92	93	94	95	96
30	15	171	172	173	174	175	176
45	15	161	162	163	164	165	166
60	15	151	152	153	154	155	156
90	15	141	142	143	144	145	146
80	10	131	132	133	134	135	136
80	5	111	112	113	114	115	116
15 Minutes	30	101	102	103	104	105	106

**A method to determine the required resistances for starting and running wound rotor motors.**

**By G. I. Stormont**

lation, the motor operating characteristics as determined from running light and locked rotor tests should be known, in addition to the nameplate data, load characteristics and duty requirements. For shop use where accuracy of results may not be so particular, certain approximations are in order. The following formulas are easy to use and for most purposes may prove satisfactory. The data required may be obtained from the motor nameplate or estimated from the duty expected. The approximations result from assuming the exciting current to be negligible and the flux to remain constant and proportional to the induced voltage in the rotor at no load.

where

$R$  = total resistance in ohms per phase in the rotor circuit, including the rotor winding and the external star connected resistor. It may be assumed in the calculations that the rotor is star connected.

$K$  = a motor constant as calculated from full load data.

$E$  = the open circuit voltage of the rotor between slip rings at standstill.

$S$  = slip of rotor expressed as a decimal.

$T$  = torque of the load in lb. ft.

$HP$  = output horsepower of the motor.

$I$  = rotor current in amperes per ring.

$P$  = watts dissipated in the resistance.

An example is given to show the application of the above formulas. The following data were obtained from the nameplate of a slip ring motor:

50 horsepower  
440 volts  
3 phase  
60 cycles  
4 pole  
1770 rev. per min.  
62 amps. full load current  
260 volts open circuit between slip rings at standstill  
85 amps. rotor current at full load with rings shorted.

(Continued on page 106)

$$R = \frac{K \times E^2 \times S}{T} \text{ ohms} \quad (1)$$

$$T = \frac{HP \times 5252}{Rpm} \text{ lb. ft.} \quad (2)$$

$$K = \frac{T}{1.73 \times E \times I} \quad (3)$$

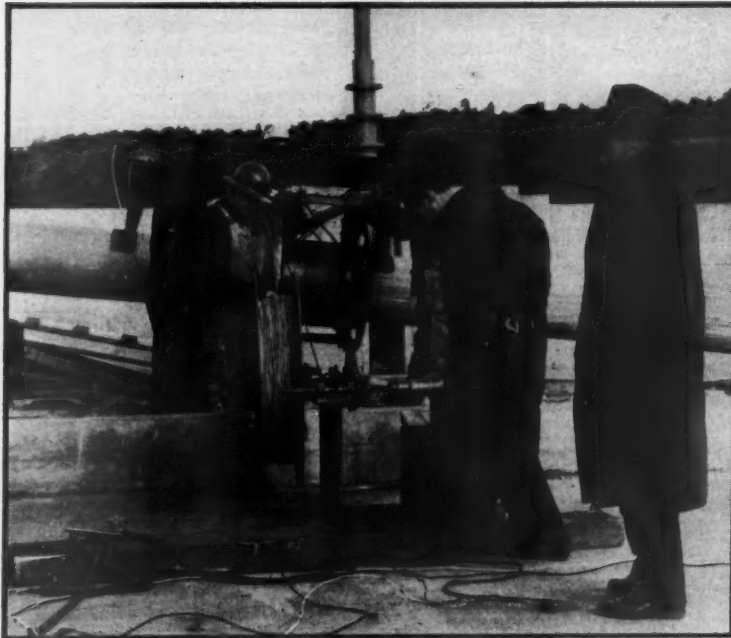
$$I = \frac{E \times S}{1.73 \times R} \text{ amps.} \quad (4)$$

$$S = 1 - \frac{Rpm \text{ of rotor}}{\text{Synch. speed}} \quad (5)$$

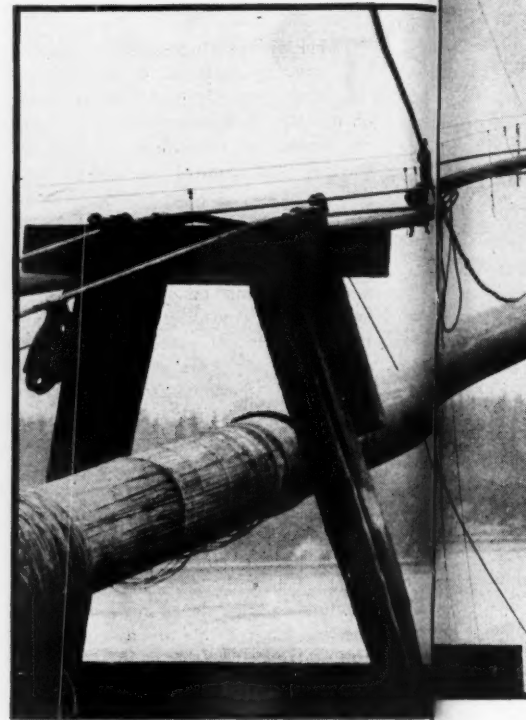
$$P = I^2 \times R \text{ watts} \quad (6)$$

# MAINTENANCE TRAVELER

Electrical contractor's unique underside carrier system that was never used became a "topside" demolishing system on Tacoma bridge.

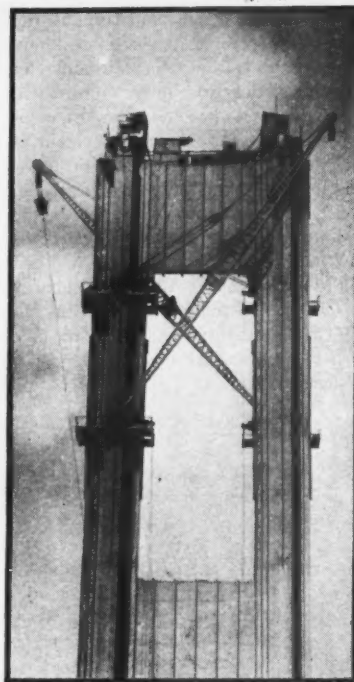


UNWINDING MACHINE in operation on Tacoma Narrows bridge to salvage main cables. This application is at the approach road bed.



SOME three years ago the public was startled and the engineering world set agog by the failure of the Tacoma Narrows Bridge. When the deck of the great suspension structure was weaving and rippling in the wind, electricians in the employ of the American Machinery & Electric Co. were just finishing up the wiring and by crawling out on the deck helped two of the endangered people to safety. A. G. Nickelsen, president of the American company, was in his office in Tacoma when his men called in to tell him of the peculiar actions of the long span, indicating that it could not last much longer.

Down into the waters of Puget Sound finally went the major part of the wiring work together with a clever idea that had been worked out and partly installed by Nickelsen as the electrical contractor for the complete electrification of the bridge. In his shop and warehouse at the time stood most of the



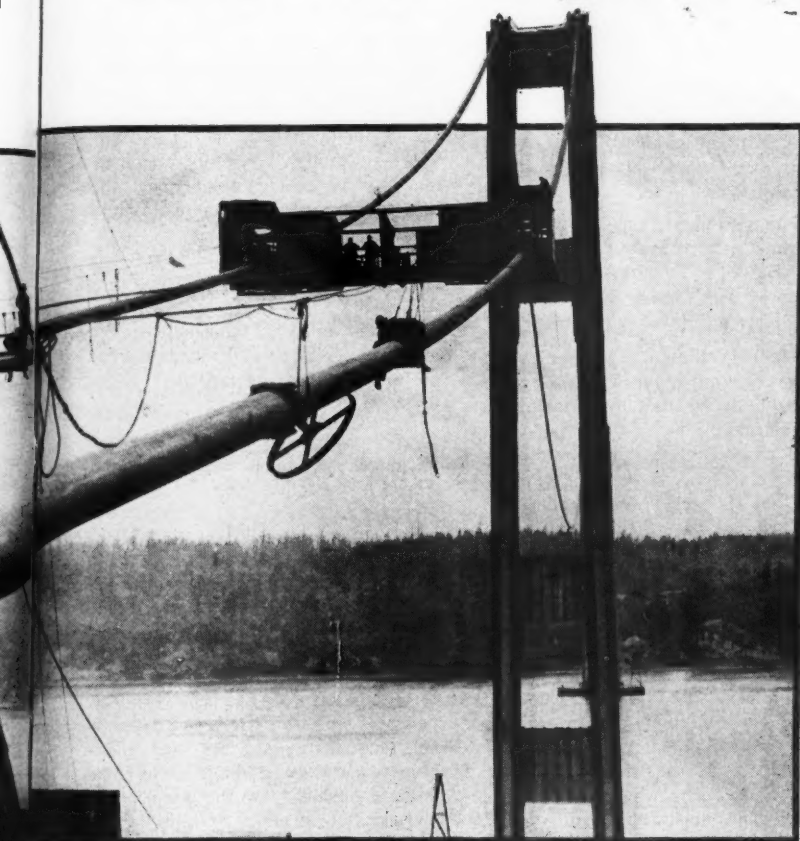
CABLES SALVAGED, tower dismantling starts. A 175 hp. engine provides power.

elaborate electrical equipment to be used in carrying out the idea, including gas engines, generators, motors, etc.

The novel feature referred to, which was embodied in the electrical wiring and equipment contract, consisted of four electrically operated carriers, or travelers as they were called, to be installed under the deck something on the order of traveling shop cranes. These were to be used by painters and inspectors in the maintenance of the bridge. There were to be two under the 2,800-ft. main span and one each under the approaches. The travelers and their motive equipment were eventually used in salvaging the four great suspension cables.

These travelers were designed by Clark Eldridge, United States Toll Bridge Engineer, in charge of the Narrows bridge under Charles Andrew. He later went to Guam, in charge of construction of the base there and is now a prisoner in Japan.

# USED FOR SALVAGE



A. G. NICKELSEN, president of American Machinery & Electrical Co., electrical contractors, headed up electrical work on this unique project.

RE-DESIGNED TRAVELER on the home stretch after working from mid-span. These machines are raised from a scow to the cables by their own power.

It was left to Nickelsen to equip the carriers for electrical operation. It would have been a simple matter to have operated them direct by electric motors, but that would have involved some kind of trolley wire to provide current and deemed hazardous in some respects by the Bridge Authority.

Nickelsen, therefore, equipped each traveler with its own complete power plant, so that it would be able to propel itself back and forth over the tracks provided for it without recourse to outside current. The equipment, which had been ordered and already delivered, consisted of a 5-hp. gasoline engine driving a 3-kw. direct current generator. This in turn provided the current for operating two 1½-hp. d.c. motors on each traveler. Direct current was employed as the simplest and most economical of operation, since there was no appreciable transmission distance involved.

Of all the things Nickelsen had done in the electrical construction and main-

tenance line, he says that this fly-on-the-ceiling installation intrigued him perhaps most of all. He was really getting anxious, and so were all of his men, to get to operating his miniature railroad travelers back and forth under the span and some 200 feet above the waters of the Sound. When the crash came it left them all pretty flat and downhearted. "Our morale was low," he said, "as far as bridges were concerned. But now comes along this other thing and we get to operate our travelers after all. Gives us quite a lift."

This other thing, by virtue of which he got an additional contract, is in connection with the dismantling of the four 17½-in. suspension cables. Each of the cables, containing 6308 No. 6 longitudinal wires, is wound around and around with spiral wires. The total weight of the cables is 3817 tons. They are being taken down and salvaged by an operation the reverse of the erection operation. The wires which were orig-

inally wound around the longitudinal wires to bind them together must now all be unwound and recoiled on bobbin-like spindles.

Some kind of traveler had to be used to follow the cables and carry the intricate equipment. The conclusion was reached to use two of those originally built for under-deck operation, with slight additions to the length and the necessary modifications of wheels to make them conform to the cable instead of the track. On each carrier over each cable is mounted the motor-driven unwinding equipment. Two of the gas engines are mounted on each traveler, driving two generators which furnish current for a number of electric drills, which carry and turn a series of bobbins and revolve around the cable as the motors propel the traveler forward. Motors have also been added to lower the coils of re-wound wire when filled to barges on the water below.

Plans are under way by Charles Andrew, noted engineer, and his staff for a new bridge, and all Tacomans wish him top speed. Only the original caissons will be utilized. They are of the cellular type filled with concrete. Wider caps will now be put on these caissons and wider and higher towers erected upon them for the new bridge. When it is under way there will be another electric wiring and equipment contract to be let.

# Editorials

W. T. Stuart, Editor

## Electronics Ahead

Whether he likes it or not, every man who handles the installation or maintenance of electrical equipment is going to have to learn something about electronics. The day is not far off when there will be a great expansion of the use of electronic devices in industrial plants, commercial buildings, and perhaps even in the home. This equipment will have to be installed and maintained by the type of men who read this magazine. There is no question about that.

That doesn't mean that we have to go into the radio servicing field—not at all. But, it does mean that we have to know how electronic equipment operates, what it can and can not do, what its troubles are and how they can be corrected.

In a sense, all of us will have to go back to school for awhile and learn about something new. Undoubtedly, the time to start is now and we humbly suggest that every reader should own at least one good text book on the theory of electronic equipment and another on practical servicing. A small investment in time and money today will surely pay dividends in the very near future.

## Code Modifications

Under pressure of emergency conditions, we have seen a number of modifications of the National Electrical Code and undoubtedly many people outside of the electrical field wonder if our standards were not too high in the first place. Let us not forget for a minute that the Code has always

represented minimum standards and that every requirement was based upon the most careful study by all factors in the industry.

Occasionally, one group or another has tried to break down some requirement for its own special benefit, but the Code has nevertheless remained a model set of rules—rules that were fair to the industry and to the user of electrical products alike. Even in casual conversations with people outside the industry, we can accomplish a lot if we explain that while some modifications have been made because of emergency conditions and in order to conserve critical materials, the N.E.C. is, and always has been, designed to protect the man who has electrical wiring and apparatus in his home, office, or factory.

Once the war is over, we will have to go back to accepted standards. Perhaps the lessons of the war will teach us that some standards are too low and must be revised. In any event, we might as well begin explaining to the general public just what the Code is all about and how things that "get by" during the war will be unsatisfactory in peacetimes.

## Deferred Business

Many a contracting organization is so preoccupied with rush work, with getting an adequate labor supply, and struggling to get materials that little or no thought is being given to lining up business for the postwar era. Some companies nevertheless have taken time to sit down with their peacetime customers and try to find out what they will need in the way of modernization and new construction when normal

times come.

It seems to us that this approach will pay big dividends to a lot of other contractors. Most of them have a list of regular customers and it is a simple matter to do a little bit of selling right now. Wiring surveys can be made, layouts for future lighting installations can be prepared and various other ways can be found to perform a real service, even though some of these customers may not be able to get the necessary priority to do any work right now.

It goes without saying that this type of service should be paid for, just as any other engineering service. This adds up to an immediate source of revenue, plus a solid foundation for profitable postwar operations.

## What About Prices?

Although the electrical contracting industry has been abnormally busy for more than two years, no fortune has been made. In a great many cases industrial jobs have been let on a fee or cost plus basis, but the average percentage of profit has been very low. In a real sense this has been an honorable contribution to the war effort because certainly no one is out to make millions of dollars on the war.

Today, construction is tapering off and from now until the end of the war it is likely that total construction will run about as much as in a normal peacetime year. Having accustomed ourselves with a low percentage of profit on a large volume of work, will we now continue to accept that same low margin on a much smaller volume of work? It would seem to be time for every contractor to analyze carefully his overhead costs, take a good look at the probable amount of work that he can get in the next year or two, and take steps to secure an adequate margin of overhead and profit on this reduced volume. That is only sound business.

## Residential Contracts

The residential market is to take on vast proportions after the war. Careful investigation of past trends points the way. In 1932 the annual kilowatt hour consumption was 600

kwhr. average per residential customer. By 1942, energy consumption had jumped to 1015 kwhr. per customer. The average annual increase over the past six years has been 50 kilowatt hours per year. From all indications this rate of increase will become much more rapid in the postwar era when residential consumers begin buying 1000 watt television units. Electric ranges, roasters, refrigerators, kitchen sinks, water heaters and appliances galore will be bought. Air-conditioning and cleaning units will be installed. Workers, who have become accustomed to high illumination levels will not be satisfied with dimly lit homes. All this boils down to heavier or additional services and circuits, plus the installation work of heavy equipment. The majority of present housing will have to be rewired. All of the temporary housing projects will have to be recontracted.

To the electrical contractor this vast postwar residential market should be of far greater importance than ever before.

## Local Associations

Local associations have always been the backbone of cooperative effort in the electrical industry. That was true before the war and it is still true today. They are the only local means of keeping the various parts of the industry in close touch with each other and of heading up the concrete planning for sales promotion work which will be so essential when peace comes again.

Many of the leaders of our industry are swamped with work and have to spend long hours of overtime at desks in the field. Under such conditions, it is only natural to begrudge the time that must be spent in association meetings or on planning committees. But this work must be done by someone and the best thinking power of all our local leaders is needed right now if we are to be prepared to get our full share of the consumer dollar after the war.

It will be a tragedy if even a single association fails to do its full part. Whenever and wherever that happens our whole industry will lose ground that will be costly to recover, in both time and money, after the war ends. Let's do the sensible thing—let's keep up our association work at all costs and help in any way that we can.

## Jack and Heintz

Jack and Heintz, of Cleveland, have made something of a record in employee relations during the war. Mr. Jack has spoken before numerous groups of executives and invariably has gotten a warm reception and has left behind him many men and women with thoughtful minds.

To be sure, the electrical contracting industry has certainly enjoyed superior labor relations over a period of years. It has been a strikeless industry. But because we have been progressive in our dealings with labor does not mean that we can stop here.

The construction business has problems that are vastly different than those encountered in running a factory.

However, the fact remains that Jack and Heintz are doing things that deserve careful study on the part of every business executive. They have tackled such things as vacations with pay; they have provided vacation centers for their employees; they have aimed at job stability; they are interested in greater safety for each worker.

Obviously, we can not copy all their methods, but at the very least we can take them apart to see what makes them tick, and in doing so we may learn some valuable lessons that will be of immeasurable help in the postwar period.

## Job Safety

Construction work has always been more dangerous than the average occupation. Many accidents are caused by defective tools and by broken ladders.

It is becoming increasingly difficult to get new tools and consequently the disposition is to try to make the old ones serve a little bit longer. It may be hard to get ladders at times. Consequently, an effort is made to repair them, but in the haste of modern construction, a satisfactory repair job may not be done.

Every little bit of carelessness in this respect can lead to unnecessary accidents and result in lost time. We owe it to ourselves, as well as to the war effort, to keep a watchful eye on every piece of equipment we send out on a job. We must make sure that every workman labors under the safest possible conditions.

## Job Costs

American business men traditionally have had trade secrets that they liked to keep to themselves. Almost every company has felt that it had at least a few methods that were distinctively superior to those of its competitors. To a great degree, the war has broken down these veils of secrecy and today we find industrial competitors freely swapping details of their production methods and sharing the fruits of laboratory research. There has been a genuine effort to help each other keep costs in line and do everything else possible to help the war effort.

Perhaps American industry will go back to its old habits once the war is over, but this seems doubtful. For one thing, there is every likelihood that the government will force sharing of patents. For another, industry has learned that many of its secrets actually were not secret and that everyone gains through a free interchange of information.

Electrical contractors, too, have had their trade secrets down through the years. Most carefully guarded of all have been job labor cost records. Some companies painfully built up rather complete data. It was only natural that they did not want to share this information with other organizations which spent neither the time nor money to build reliable records.

Looking ahead toward the intense competition of the postwar era, it is fair to ask whether it would not be to the advantage of the entire industry to share these costs records. Much of the cut price chaos that has affected our industry has been based upon incomplete analysis of costs. Many a man went broke because he didn't know his costs. Unfortunately, while these men were in the process of hitting the bankruptcy trail, they made it next to impossible for the sound companies to operate profitably.

Sharing labor cost records, at first glance, may seem rather revolutionary. Undoubtedly industrialists felt the same way when they started to share price, research and production data. However, like the industrialists, electrical contractors would surely find the benefits they got greatly outweighed any temporary advantages that they might individually lose. Here is an industry job on which a start can be made today, with the certainty that the postwar results will be highly beneficial to all of us.

# Methods

**BRIEF ARTICLES** about practical methods of installing and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

## TEST BOARD

### INDUSTRIAL

A test board is as essential to electrical maintenance as a pair of side cutters or a screw driver. The more complete it is made, the more valuable it becomes. Paul Katz, electrical foreman for Hammarlund Manufacturing Company, has built a board which fulfills all his testing requirements.

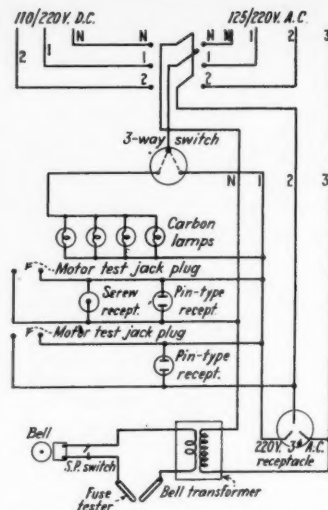
A three pole double throw switch provides either direct current or alternating current as desired. Direct current is available at 110/220 volts three wire; alternating current 125/220 volt three phase four wire.

A set of four carbon lamps can be cut into or out of the test lead circuits. Two test circuits are provided and by the proper switching, 125-volt a.c. or 110-volt d.c. can be obtained on one, and 220-volt a.c. or d.c. can be obtained on the other. Each of the test lead circuits are also provided with pin

type receptacles. A loose screw-type receptacle is provided in the 125-volt test circuit for quick testing of lamps. Plug-in power at 220 volts 3 phase is obtained from a polarized three-pin type receptacle.

A bell ringing transformer is placed in the 125-volt circuit for bell voltages to test fuses. Two copper strips are arranged in a V shape and placed in the bell circuit, making it possible to test any size cartridge fuse. Two short leads, one from each strip make other low voltage testing possible.

The use of carbon lamps in the test circuits makes it convenient for locating grounds, short circuits, and open circuits in any type of equipment brought in for repairs. They also facilitate tracing out circuits in control units. By flipping the 3-way switch to the other terminal, cutting the lamps out of the circuit, it becomes possible to operate for testing purposes single phase motors on the test leads, or to operate other equipment such as soldering irons (used



**WIRING DIAGRAM** of test board which provides a.c. or d.c. power at two voltages plus a bell-ringing circuit for fuse testing. A three-way switch inserts four paralleled carbon lamps in series with the test circuit. A three-pole double-throw switch provides the a.c. or d.c. as desired.

in radio parts production) from the pin-type receptacles provided in the test circuits. All circuits, switches, lamps, leads and receptacles are clearly marked for proper identification.

## FISHING CONDUIT

### WIRING

Wiring in finished walls is very often a tedious and ticklish task, but Wheeling Electric of Vincennes, Indiana has facilitated the job by the use of EMT. As an example, the installation of a wall switch with a wall bracket outlet 28 inches above is detailed to illustrate the procedure.

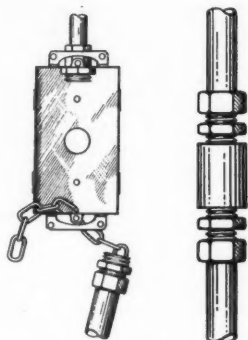
After cutting holes in the wall for the switch and the outlet box, a hole is drilled in the partition plate in the basement large enough to accommodate a pipe coupling and connector of the same size as the conduit used. The outlet box is installed and conduit lengths measured. In this case the conduit connecting the boxes is 28 inches long and the drop to the basement from the switch outlet box is five feet. Connectors are installed on both ends of the 28 inch length and on one end of the five foot length. The two lengths are then coupled together by an ordinary pipe coupling (as shown in sketch) and shoved up into the partition where the short length is fastened into place in the bracket outlet box with a locknut. Working through the hole for



**SHOOTING TROUBLE** on this small motor, Paul Katz, electrical foreman is using the carbon lamps to test for an open circuit.

[FROM PAGE 52]

the switch outlet box, the pipe coupling is unscrewed and the lower section dropped a few inches. A chain is then inserted in the conduit. The outlet box is set on the upper conduit with the



**CHAIN** is used to guide the conduit back into the switch outlet box (left). Wall is sectioned away to show the procedure. Thin wall connectors are coupled loosely with an ordinary pipe coupling (right).

chain threaded through the bottom knockout. The chain then guides the lower conduit into the knockout and the locknuts can be turned on. The run is then ready for pulling wire.

## TRANSFORMER KEEPS M-G SET RUNNING

INDUSTRIAL

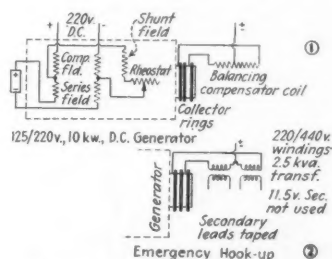
The motor-generator set was down and there was no d.c. current. What's more, there was no spare unit available at the time. That was the problem confronting John R. Matellic, chief electrician, RCA Victor Division of Radio Corporation of America, Indianapolis, Indiana. The set supplied all the magnetic chucks, various grinders and the current was used for all testing of the sound equipment. Being a total war plant, it was vital that the set be restored to service in the shortest possible time.

Investigation showed that the balancing coil (schematic diagram 1) of the 10 kw, 125/250 volt, d.c., 3-wire generator had gone up in smoke. This was a specially built reactor for this particular machine and delivery of a new one could not be made in less than six weeks—probably much longer. Consequently the burned out coil was removed and sent out to be rewound. But that meant at least a week's delay and still didn't solve the problem of immediate operation of the set.

So, John dug down into his bag of maintenance tricks and came up with a "kink" that saved the day and kept production rolling. The coil, which provides a neutral potential between the outer line wires of the d.c. generator, was nothing more than an ordinary three-wire auto-transformer. John's

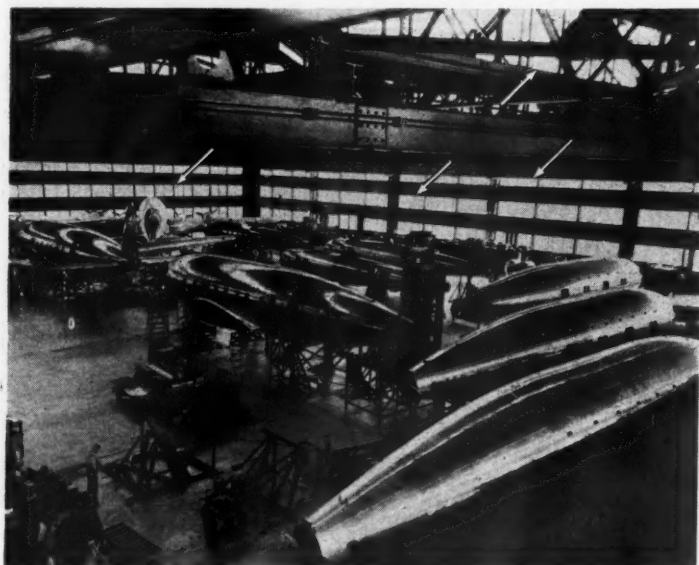
thought was to substitute an ordinary transformer for the coil; or even a three-phase motor, since the winding was equally divided.

Fortunately there was handy a spare 2.5 kva. double wound transformer of the proper primary voltage rating. This was pressed into service and connected as illustrated (schematic diagram 2).



**EMERGENCY CONNECTIONS** show the substitution of an ordinary double wound transformer (2) for a burned out balancing coil (1) to keep a motor-generator set in a vital war plant operating.

The two primary coils were tied together with the center point serving as the neutral. The outer leads were connected to the same terminals on the set as the original reactor coil was. The secondary coils of the transformer were left "floating" with their leads taped up. This little trick returned the M-G set to service in a remarkably short time and kept production rolling until the rewound balancing coil was delivered.



**BLACKOUT SHUTTERS** of galvanized metal (see arrows) cover continuous sidewall sash and vertical sawtooth monitor sash overhead in one of Boeing's Austin-built plane plants on the Pacific coast. The lighting system, supplemented by concentrated lighting built into and around huge assembly rigs, was originally designed for efficient night operations.

## V-BELT DRIVE

INDUSTRIAL

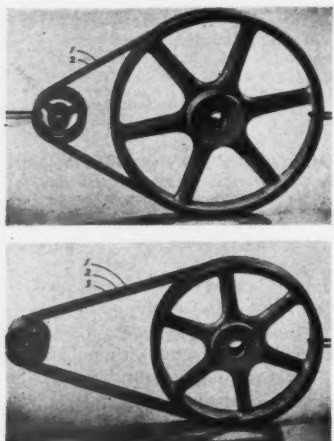
Allis-Chalmers has come through with a plan for re-application of V-belt drive which is claimed will save a quarter-million pounds of crude rubber this year. It is proposed to shorten center distances and use larger sheaves on all new applications.

It was pointed out that in the past, the engineering of individual V-belt drives has been governed largely by such considerations as convenience, habit and machine design, but today the most important consideration is saving rubber for our dwindling stock pile. It is claimed that a saving of 15 percent can be realized in the purchase of a new drive and 35 percent on that ordinarily spent for replacement.

Since higher belt speeds multiply the horsepower rating of belts several times, a slight increase in sheave size will allow center distances to be shortened and a saving in the number of belts required for the drive. Although the sheave size is increased, the reduc-

tion in the number of grooves often results in a net decrease of sheave weight.

The question has been raised, will higher belt speeds wear out belts faster? A negative answer was explained by the



**SHEAVES** 12-inches and 3 inches for 2 hp. motor with 1740 r.p.m. full load speed are shown in the lower illustration. The results with the longer center distance is a drive capacity of 2.7 hp. (0.9 hp. per belt) and a belt speed of 1360 r.p.m. In the upper illustration 15-inch and 3.8-inch sheaves are used at shorter center distance with resultant drive capacity of 2.8 hp. (1.4 hp. per belt) running at a belt speed of 1670 r.p.m.

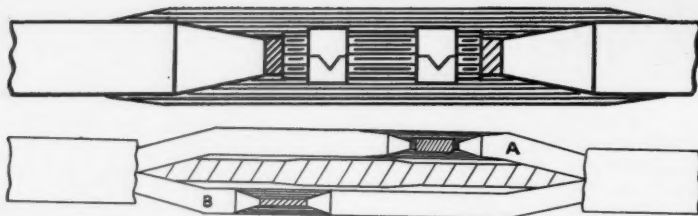
fact that the greatest danger threatening belt life is flexing too sharply around smaller sheaves. Use of larger sheaves will therefore help to eliminate this prime factor in belt failure.

## CABLE SPlicing

WIRING

Suggestions on repairing and splicing single and multiple conductor rubber jacketed cables were recently made by the Simplex Wire and Cable Co.

After splicing the single conductor cable, the insulation is scarfed or penciled by four to five times the rubber thickness as illustrated. The scarf and cable is then coated with cement for two inches beyond each scarf. As the cement becomes tacky, rubber splicing tape is applied between scarfs until the thickness over the conductor splice is equal to that of the original insulation



**SINGLE CONDUCTOR** cable showing splice, scarf and rubber tape (upper). Multiple conductor cable showing treatment of individual conductors (lower).

and jacket. If the splice is to remain unvulcanized then friction tape is applied overall  $\frac{1}{2}$  lap to two inches beyond scarf. A coat of waterproof paint completes the operation. Vulcanization is recommended especially under damp conditions. A sharp knife slightly moistened will facilitate scarfing.

In the case of multiconductor cable the following procedure is recommended:

1. Open cable and remove damaged insulation. Splice conductors as in conductor A above where necessary. If cables are shielded type, split shield and tie back out of the way for further use. Spliced conductors should be staggered as shown. Ground conductors should be spliced if necessary and covered with friction tape.

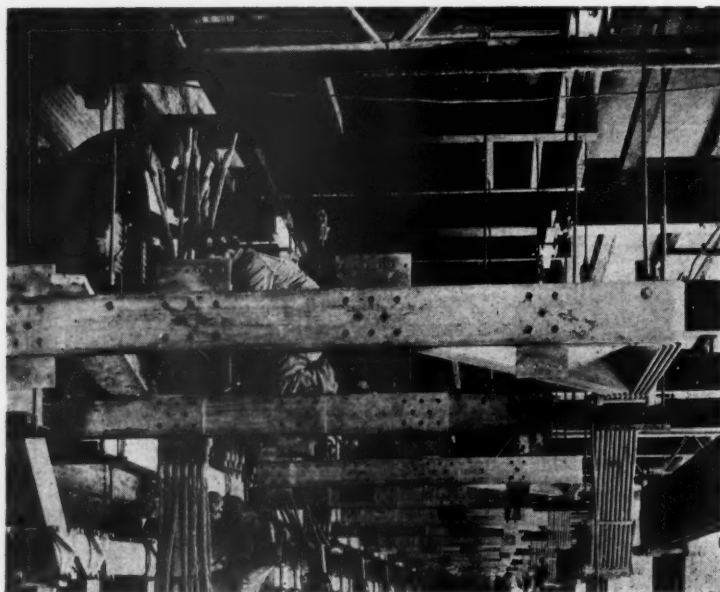
2. Scarf insulation as shown. Length of scarf four to five times thickness of insulation. Clean and apply coating of rubber cement over scarf and for one inch along conductor insulation. Allow

cement to become "tacky."

3. Apply rubber splicing tape between scarfs. For repaired conductors, make diameter over repair equal to that over the original insulation. For spliced conductors, make thickness of rubber over splice equal to that of the original insulation. Apply one layer of friction tape one-half lap. If cable is shielded type replace conductor shields.

4. Pull conductors together—lay in jute fillers in interstices and apply one layer of friction tape. Replace shield if present.

5. Scarf jackets—length of scarf four to five times thickness of jackets. Clean and apply coating or rubber cement over scarfs and 2 inches along cable. Allow cement to become "tacky." Apply rubber splicing tape between scarfs until thickness equal that of the original jackets. If repair or splice is unvulcanized apply one layer of friction tape ( $\frac{1}{2}$  lap) over all and paint with a waterproof paint.



**CANOPY OF SILVER** feeds power into magnesium cells at a Dow Magnesium Corporation plant built by the Austin Company for the DPC. Solid silver bus bars, loaned by the government to release copper for war material, are supported by steel rods connected near their mid point by double clevised gun strain insulators.



## Design for Lighting—Today and Tomorrow

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It is another fluorescent first for Sylvania

— this all-purpose standardized fixture of the future.

The streamlined top-housing, which weighs less than three pounds, encloses the ballast and protects it from dust.

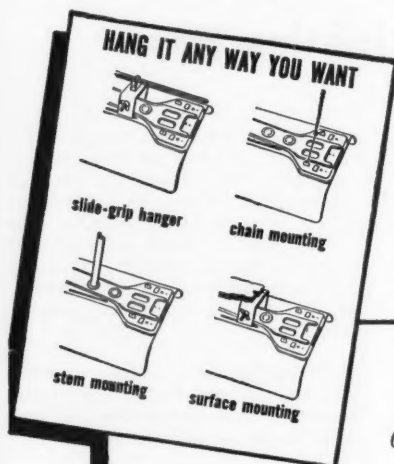
Optional knockouts permit any known type of mounting. And it fits into any lighting plan — individual or continuous row.

Two or three lamps can be used, depending on light output desired.

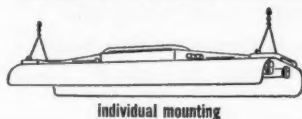
There is an accessible starter socket and knockout provision for a pull chain if need be.

The fixture is equipped with a light and durable composition reflector that has a designed-in efficiency of 86 per cent — even higher than that of porcelain-enameled metal in conventional contours. This reflector stands up under extreme temperature and humidity conditions. "Captive Latch" fastenings that require no tools for removal make it easy to service.

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individual mounting



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- \* Is Illumination Adequate for Safe and Easy Seeing? (See Pages 10-13)
- \* Is Glare Interfering with Workers' Efficiency? (See Pages 14-15)
- \* Are Shadows Handicapping the Worker and Creating Accident Hazards? (See Pages 18-19)
- \* Are Surroundings Contributing Best Possible Seeing Conditions? (See Pages 16-17)
- \* Does Your Maintenance Insure Maximum Lighting Efficiency? (See Page 20)
- \* Is Everything Being Done to Conserve and Protect Workers' Eyes? (See Page 21)

plant efficiency by  
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Now . . . before the dark fall and winter days increase your dependence upon good lighting . . . is the time to check your lighting system and the maintenance methods employed to keep it at peak efficiency.

The National Better Light—Better Sight Bureau has developed a new light-sight check up plan which we shall be glad to explain to you. With the aid of this plan you will be able to recognize the conditions in your plant which are detrimental to good seeing, to locate the faults and to determine what changes and improvements should be made.

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As a war plant, you will be able to obtain the necessary equipment to make the needed improvements in your lighting system, to conserve employees' energy, reduce accidents

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Benjamin Field Engineers and Benjamin Distributors are co-operating with local electric leagues, power companies and others. A copy of this plan will be presented to you in person by a lighting specialist. He will be glad to work with you in whatever way you desire in making your lighting check up. If desired, he also will make specific recommendations.

For further information, write us, and we shall see that a "Sight-for-Victory" book is delivered to you without cost or obligation.

Published in the Interests of Better Seeing Conditions for Better Work and Better Health  
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# BENJAMIN

## Lighting Equipment

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# Industrial Electrification

## CRANE-BRIDGE BRAKES

**A**CCURATELY timed operations are an important link in mass production technique—whether they are integrated in the actual production line or in material handling equipment. Overhead power cranes do an important job of moving heavy equipment and materials in industry. The degree of efficiency is a function of the condition of the crane, the skill of the operator and the control facilities placed at the operator's finger-tips.

Accurate crane spotting for picking up and delivering materials saves many production man-hours. Much of this saving depends on the condition of the braking system, as does the safety of the operator in the cab.

With the present necessary shift to unskilled men and women operators, braking system maintenance cannot be overlooked. The brake unit is so coordinated with crane motive power that the responsibility of keeping it in A-1 operating condition falls under the jurisdiction of the electrician maintaining the crane. This is true whether the system be electrical, mechanical or hydraulic in principle.

The attendant article reviews the operation and maintenance of one of these systems—hydraulic bridge brakes.

Previous articles covered—  
Electrifying Operations to Reduce Unit Costs  
Safety Protection for Electrical Operations  
Increasing Flexibility of Electrical Service  
Electrical Aids to Automatic Control  
Electrical Ways to Reduce Waste  
How to Save Power  
Protection Against Sabotage  
Improving Working Conditions  
Electrifying for Continuous Operation  
Electrified Plant Housekeeping  
Electrical Problems Under 168 Hour Schedules  
Electrical Aids to Plant Conversion  
Electrical Aids to Quality Control  
Electrical Aids for Green Help  
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Air Raid Restoration  
Operating Replacements  
Preparing for Blackouts  
Wiring for Quick Changes  
Power Factor Improvement  
Electric Heat Speeds Production  
Hydraulic Bridge Brake Maintenance (this issue)

ENGINEERING · INSTALLATION · MAINTENANCE

## HYDRAULIC BRIDGE BRAKE MAINTENANCE

An outline of the operation and maintenance of hydraulic bridge brakes for overhead bridge cranes and other industrial equipment.

By J. S. Smith

Manager, Industrial Sales Department, Wagner Electric Corporation, St. Louis, Mo.

**H**YDRAULIC bridge-braking systems are becoming increasingly more popular as a braking medium, particularly on overhead traveling cranes. The attachment of efficient, powerful, foot-operated brakes to crane bridge drives has become a practical necessity because of:

1. Higher crane speeds and the use of roller bearings which, in the event of power failure, increase the danger of the crane going through the runway end-bumpers.

2. A need for more accurate load spotting than is possible with motor reversing or plugging as a braking medium. This is double important today when manpower shortages necessitate the training of inexperienced operators.

The fundamental objective is to provide brakes of sufficient size to adequately stop the crane under emergency as well as normal conditions, with foot pedal pressures within the physical limitations of the operator. Where the crane is in continuous service, pedal pressures over 65 pounds are objectionable from the standpoint of operator fatigue.

Although there is nothing electrical about this particular brake, its care and

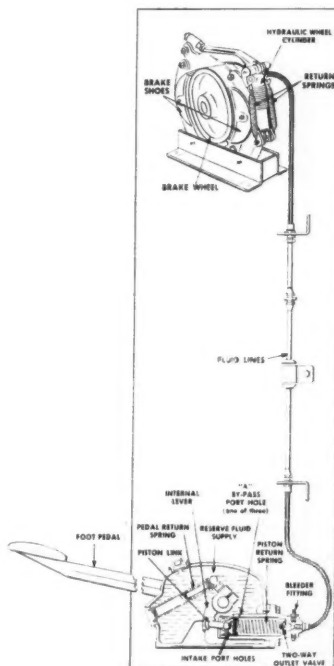


FIG. 1—COMPONENT PARTS of a typical, simple hydraulic brake system showing master cylinder assembly in cross-section.

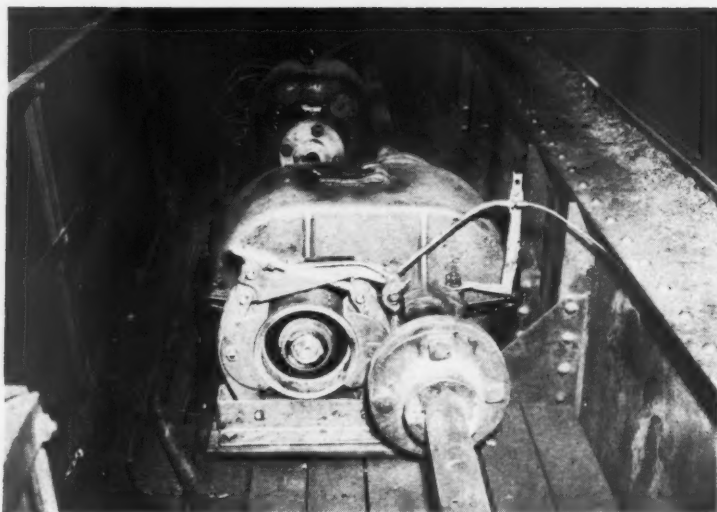


FIG. 2—BRAKE UNIT keyed to the gear box of the bridge drive motor on an overhead traveling crane. Hydraulic line goes to master cylinder pedal in cab.

maintenance normally comes under the jurisdiction of the maintenance electrician servicing the crane. Hence hydraulic bridge brake operation and maintenance is properly an important part of the know-how of electrical maintenance.

Before touching upon maintenance let's consider the principle of operation. The hydraulic actuation used is the same as that applied to passenger car and commercial vehicle brakes. A typical system consists of a hydraulic master-cylinder in which the hydraulic pressure is originated, a telescopic type hydraulic wheel-cylinder and the necessary fluid lines and flexible hose connections. (See Fig. 1 and Fig. 3.)

Hydraulic pressure, built up in the master cylinder in the crane cab by means of pressure on its foot pedal, is transmitted through the fluid line to the wheel-cylinder mounted between the brake arm and the brake lever. Fluid displaced from the master cylinder operates the wheel cylinder which moves the end of the brake lever-arm upward with a force approximately three times the foot-pressure, bringing the brake shoes into contact with the brake wheel. Braking torque varies directly with the foot-pedal pressure.

If maximum efficiency is to be expected, the entire hydraulic system must be kept full of fluid at all times. This is accomplished by providing three minute by-pass or compensating port holes, ("A", Fig. 1) which are closed as soon as the master cylinder piston begins to move, but are otherwise open to permit expansion and contraction of the liquid due to temperature changes.

A two-way outlet valve at the end of the master cylinder retains a residual pressure of 8 to 12 pounds in the lines

to prevent the column of liquid from draining back into the master cylinder, and facilitates removal of air from the system.

When pressure on the foot pedal is released, the brake assembly is returned to its full-release position by a tension-type spring hooked between the brake arm and lever.

If two brakes are used on the same bridge, both can be operated simultaneously through the master cylinder as four-wheel hydraulic brakes on a car.

The maintenance of crane bridge brakes can be divided into two general headings:

1. Replacement of worn-out, ineffective, mechanical braking systems with new efficient hydraulic apparatus sufficiently powerful to meet operating conditions.

2. Preventive maintenance of present hydraulic systems.

Hydraulic brake systems require periodic inspection and maintenance just as any mechanical or electrical system. In fact brakes are so important to safe crane operation that they should be one of the first items to be checked.

The foot pedal of the master cylinder in the crane cab is really the barometer to proper system operation. If everything is in order the pedal will feel "solid" under pressure. If the pedal feels "spongy" or goes all the way to the floor, under steady pressure, something is wrong and the maintenance man should be notified immediately. Crane operators should be cautioned about this and trained to report any "unusual feel" of the pedal.

Hydraulic brake systems do not ordinarily consume any fluid. However, loss of fluid might occur due to leaks; or there might be air, dirt or a "foreign" liquid in the system. All these points should be carefully checked as outlined in the accompanying Check Chart. Then it can be determined if the trouble is hydraulic or mechanical (at the brake unit) in nature.

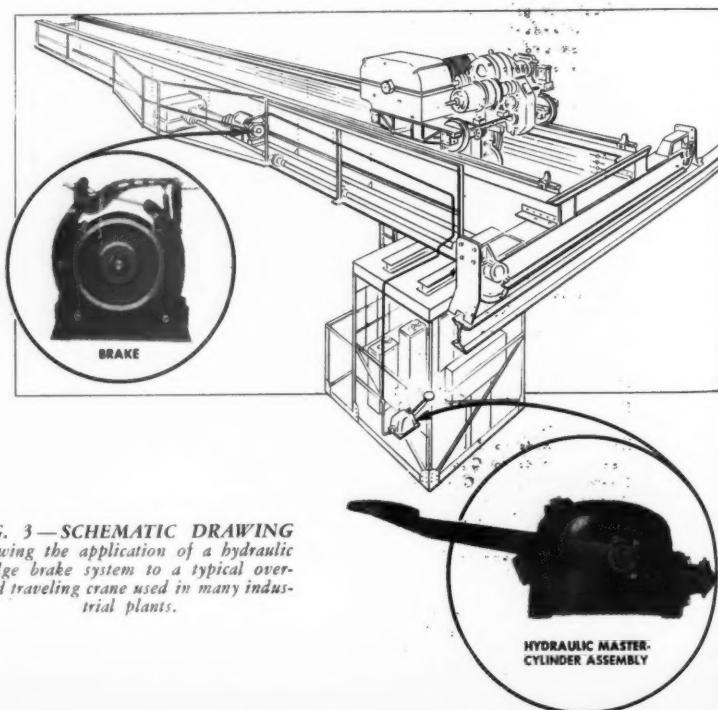


FIG. 3—SCHEMATIC DRAWING showing the application of a hydraulic bridge brake system to a typical overhead traveling crane used in many industrial plants.

# MAINTENANCE GUIDE SHEET

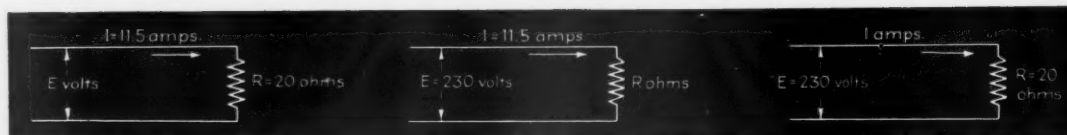
## Check Chart for Hydraulic Brake System Maintenance

SYMPTOMS	CAUSES	REMEDIES
<b>LOSS OF PRESSURE</b>	Leak in fluid lines and connections.	Check all lines, connections and gaskets.
	Leak in wheel cylinder.	Dismantle unit and check piston cup for dirt and water.  Wash in clean alcohol and reassemble with new piston cup.
	Worn or dirty piston cup in master cylinder.	Service and clean unit and replace piston cup.
<b>SPONGY PEDAL</b>	Presence of air in system resulting in "spongy" pedal, loss of pedal travel, insufficient fluid capacity, etc. Air is highly compressible, hydraulic fluid is not.	Bleed system to remove air from actuating cylinder and lines. This should always be done after a new installation or after disconnecting a system for service.
<b>SYSTEM FAILS TO OPERATE</b>	Presence of "foreign" fluids in system, such as kerosene, gasoline, mineral oil or cleaner solvent.	Prevent the introduction of anything but approved hydraulic fluid in the system.
	Swelling of master cylinder piston cup due to these liquids, causing port holes to become clogged and eliminating compensating action of cylinder.	Drain entire system.  Service wheel and master cylinders and replace rubber parts.  Flush entire system with clean alcohol.  Refill system with an approved hydraulic fluid.
<b>FAULTY BRAKE OPERATION</b>	Lack of proper lubrication.	Periodically check and lubricate hinge pins of brake units. Avoid getting oil or grease on brake linings.
	Neglect of brake adjustment or worn brake lining.	Adjust brakes periodically according to lining wear.  Re-line brake shoes before rivets or bolt heads pierce lining and score brake wheel.

# ELECTRICAL CONTRACTING DATA SHEET

F-1

## Fundamental D. C. Formulas



$$E = IR$$

$$= 11.5 \times 20$$

$$= 230 \text{ volts}$$

$$R = \frac{E}{I}$$

$$= \frac{230}{11.5}$$

$$= 20 \text{ ohms}$$

$$I = \frac{E}{R}$$

$$= \frac{230}{20}$$

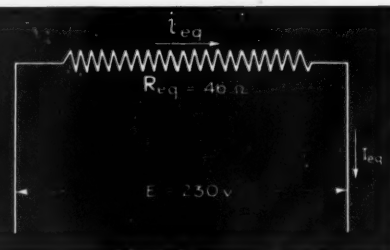
$$= 11.5 \text{ amps.}$$

## Resistances in Series

### Actual Circuit



### Equivalent Circuit



$$R_{eq} = r_1 + r_2 + r_3 + r_4$$

$$= 3 + 13 + 20 + 10 = 46 \text{ ohms}$$

$$I_{eq} = \frac{E}{R_{eq}} = \frac{230}{46} = 5 \text{ amps.}$$

$$I_T = I_{eq} = i_{eq} = i_1 = i_2 = i_3 = i_4 = 5 \text{ amps.}$$

### Voltage Drops

Voltage drop across  $r_1$  :

$$e_1 = i_1 r_1 = 5 \times 3 = 15 \text{ volts}$$

Voltage drop across  $r_2$  :

$$e_2 = i_2 r_2 = 5 \times 13 = 65 \text{ volts}$$

Voltage drop across  $r_3$  :

$$e_3 = i_3 r_3 = 5 \times 20 = 100 \text{ volts}$$

Voltage drop across  $r_4$  :

$$e_4 = i_4 r_4 = 5 \times 10 = 50 \text{ volts}$$

Voltage drop across entire bank :

$$\begin{aligned} E &= e_1 + e_2 + e_3 + e_4 \\ &= 15 + 65 + 100 + 50 \\ &= 230 \text{ volts} \end{aligned}$$

### Watts Loss

Watts loss in  $r_1$  :

$$W_1 = i_1^2 r_1 = 5^2 \times 3 = 25 \times 3 = 75 \text{ watts}$$

Watt loss in  $r_2$  :

$$W_2 = i_2^2 r_2 = 5^2 \times 13 = 25 \times 13 = 325 \text{ watts}$$

Watt loss in  $r_3$  :

$$W_3 = i_3^2 r_3 = 5^2 \times 20 = 25 \times 20 = 500 \text{ watts}$$

Watts loss in  $r_4$  :

$$W_4 = i_4^2 r_4 = 5^2 \times 10 = 25 \times 10 = 250 \text{ watts}$$

Watts loss total:

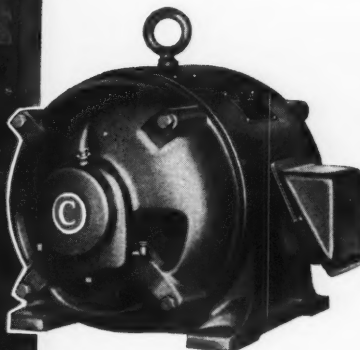
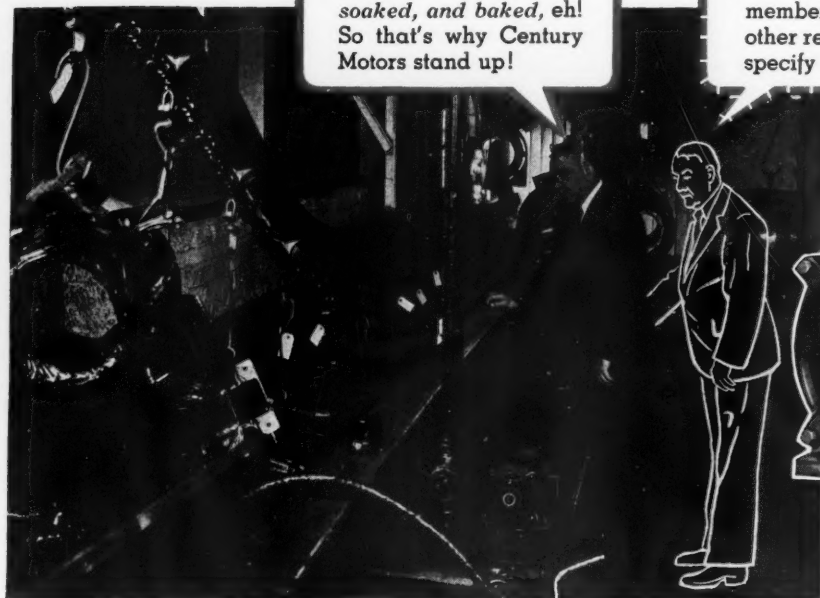
$$\begin{aligned} W_T &= W_1 + W_2 + W_3 + W_4 \\ &= 75 + 325 + 500 + 250 = 1150 \text{ watts} \end{aligned}$$

$$\text{or } W_T = I_T^2 R_{eq} = 5^2 \times 46 = 25 \times 46 = 1150 \text{ watts}$$

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Mr. Now: Dried out, soaked, and baked, eh! So that's why Century Motors stand up!

Mr. Postwar: I'll remember that — it's another reason why I shall specify Century Motors.



Century Form J Motor

## The Protection of **CENTURY INSULATION** Assures Continuous Motor Performance Under the Toughest Conditions

By the use of slow-moving conveyors and automatically-controlled ovens, the completed stator and winding of Century Motors is dehydrated, and then is submerged in and passes through a tank filled with Century "Clingto" insulating varnish, and then baked. This process is repeated as necessary to preserve and seal the winding into a homogeneous mass.

This is followed by a final coat of Century "Protecto" insulation compound which places a heavy exterior protecting armor over the entire winding.

Century slot insulation is built up with fibre board for mechanical strength and varnished cloth for dielectric strength.

The entire Century insulation process produces a winding that

is highly resistant to moisture, to tropical climatic conditions, to mild acid and alkali fumes, and to the effect of magnetic vibration and the mechanical impact of particles carried by the cooling air.

Such insulation material and treatment is absolutely necessary for motor protection for long operating life.

Your nearest Century Application and Service engineer will gladly give you full details of all the advantages of Century Motors—show you why thousands of plants rely on Century for continuous, all-out production.



### **CENTURY ELECTRIC CO.**

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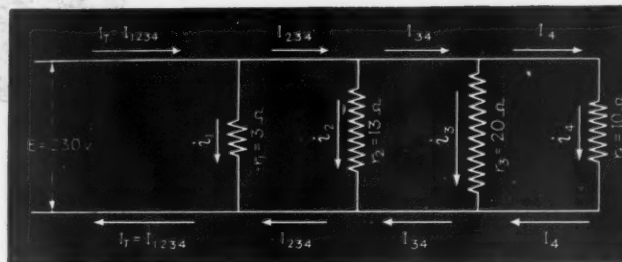
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*One of the Largest EXCLUSIVE Motor and Generator Manufacturers in the World.*

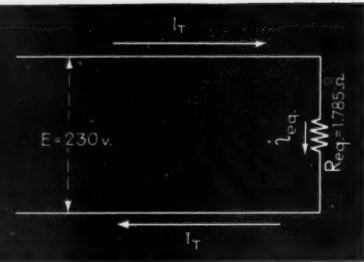
## Fundamental D. C. Formulas (con't.)

### Resistances in Parallel

Actual Circuit



Equivalent Circuit



$$\begin{aligned}\frac{1}{R_{eq}} &= \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \frac{1}{r_4} \\ &= \frac{1}{3} + \frac{1}{13} + \frac{1}{20} + \frac{1}{10} \\ &= \frac{(13 \times 20 \times 10) + (3 \times 20 \times 10) + (3 \times 13 \times 10) + (3 \times 13 \times 20)}{3 \times 13 \times 20 \times 10} \\ &= \frac{2600 + 600 + 390 + 780}{7800} \\ &= \frac{4370}{7800} \\ R_{eq} &= \frac{7800}{4370} = 1.785 \text{ ohms.} \\ I_T &= \frac{E}{R_{eq}} = \frac{230}{1.785} = 128.85 \text{ amps.}\end{aligned}$$

$$\begin{aligned}i_1 &= \frac{E}{r_1} = \frac{230}{3} = 76.67 \text{ amps.} \\ i_2 &= \frac{E}{r_2} = \frac{230}{13} = 17.69 \text{ amps.} \\ i_3 &= \frac{E}{r_3} = \frac{230}{20} = 11.50 \text{ amps.} \\ i_4 &= \frac{E}{r_4} = \frac{230}{10} = 23.0 \text{ amps.} \\ I_T &= I_{1234} = i_1 + i_2 + i_3 + i_4 \\ &= 76.67 + 17.69 + 11.50 + 23.0 \\ &= 128.86 \text{ amps.}\end{aligned}$$

**The Voltage Drop Across Each Resistance Will be The Full Line Terminal Voltage**

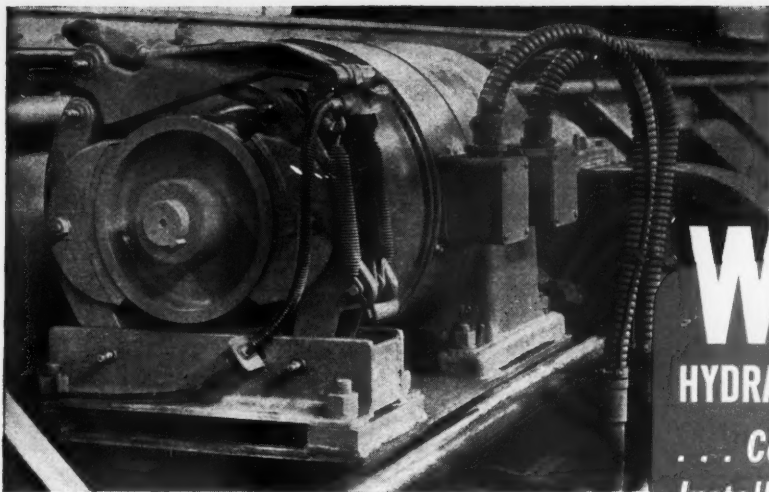
#### Watts Loss

$$\begin{aligned}W_1 &= i_1^2 r_1 = 76.67^2 \times 3 = 5878.29 \times 3 = 17634.87 \text{ watts} \\ W_2 &= i_2^2 r_2 = 17.69^2 \times 13 = 312.94 \times 13 = 4068.22 \text{ watts} \\ W_3 &= i_3^2 r_3 = 11.5^2 \times 20 = 132.25 \times 20 = 2645.0 \text{ watts} \\ W_4 &= i_4^2 r_4 = 23.0^2 \times 10 = 529.0 \times 10 = 5290.0 \text{ watts} \\ W_T &= W_1 + W_2 + W_3 + W_4 \\ &= 17634.87 + 4068.22 + 2645.0 + 5290.0 \\ &= 29638.09 \text{ watts*} \\ \text{or } W_T &= I_T^2 \times R_{eq} = 128.85^2 \times 1.785 \\ &= 16602.32 \times 1.785 \\ &= 29635.15 \text{ watts*}\end{aligned}$$

#### Watts Loss (check)

$$\begin{aligned}W_1 &= E i_1 = 230 \times 76.67 = 17634.1 \text{ watts} \\ W_2 &= E i_2 = 230 \times 17.69 = 4068.7 \text{ watts} \\ W_3 &= E i_3 = 230 \times 11.50 = 2645.0 \text{ watts} \\ W_4 &= E i_4 = 230 \times 23.0 = 5290.0 \text{ watts} \\ W_T &= W_1 + W_2 + W_3 + W_4 \\ &= 17634.1 + 4068.7 + 2645.0 + 5290.0 \\ &= 29637.8 \text{ watts*} \\ \text{or } W_T &= E I_T = 230 \times 128.85 \\ &= 29635.5 \text{ watts*}\end{aligned}$$

\*The reason all answers do not check exactly is due to mathematical limitations. If all computations were carried out to enough places, all answers would check exactly.



## MODERNIZE YOUR CRANES

*with*

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## HYDRAULIC BRIDGE BRAKES

*... Complete - Ready to  
Install on New or Old Cranes*

**T**oday, when every minute of production time is needed to hasten Victory, you cannot afford to neglect the efficiency and safety of your overhead crane brakes. The way to obtain "top" brake efficiency is to install Wagner hydraulic bridge braking systems.

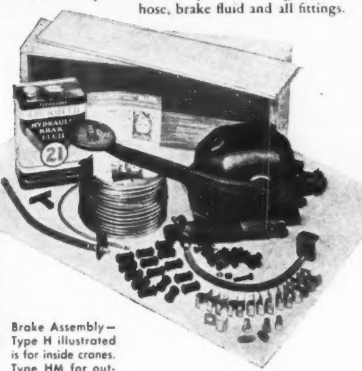
Wagner hydraulic bridge braking systems come in two types: type H for inside cranes, and type HM for outside cranes where an automatic parking attachment is necessary. A few of the many points of excellence of Wagner hydraulic bridge braking systems are:—**1.** Easy one-point adjustment... **2.** Exclusive anti-drag device... **3.** Hardened pins, knurled to prevent rotation... **4.** Bushings at all points of maximum wear... **5.** Grease fittings on all hinge pins... **6.** Extra-thick friction blocks are bolted to the shoes... **7.** A nation-wide service organization through 25 branches.



Brake Wheel furnished with bore as specified.

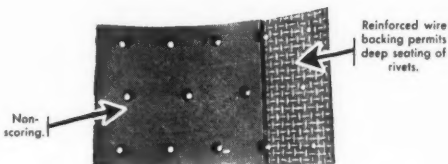


Brake Assembly—Type H illustrated is for inside cranes. Type HM for outside cranes.



The complete system includes everything necessary—brake assembly, brake wheel, master cylinder, wheel cylinder, tubing, flexible hose, brake fluid and all fittings.

## BRAKE LINING..



Preformed in blocks to fit all makes and sizes of crane brakes.

Wagner molded wire-backed blocks have the following advantages: **1.** Non-abrasive—will not score brake wheels... **2.** Suitable for use with any type of brake wheel... **3.** Preformed to size and molded to wheel diameter... **4.** Wire-backed to permit deep seating of lining bolts or rivets... **5.** Molded blocks save installation time because they are easily applied... **6.** Available from Wagner branch stock... **7.** They reduce inventory by eliminating excessive stocks of roll-type lining which is generally purchased in long lengths in order to obtain the best price.

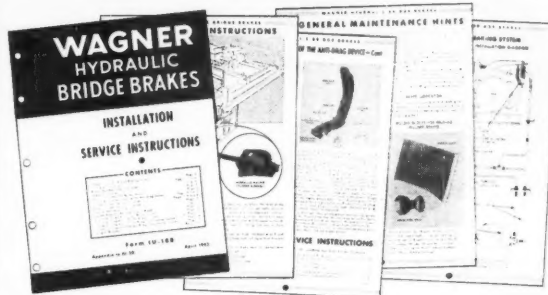


### Wagner Electric Corporation

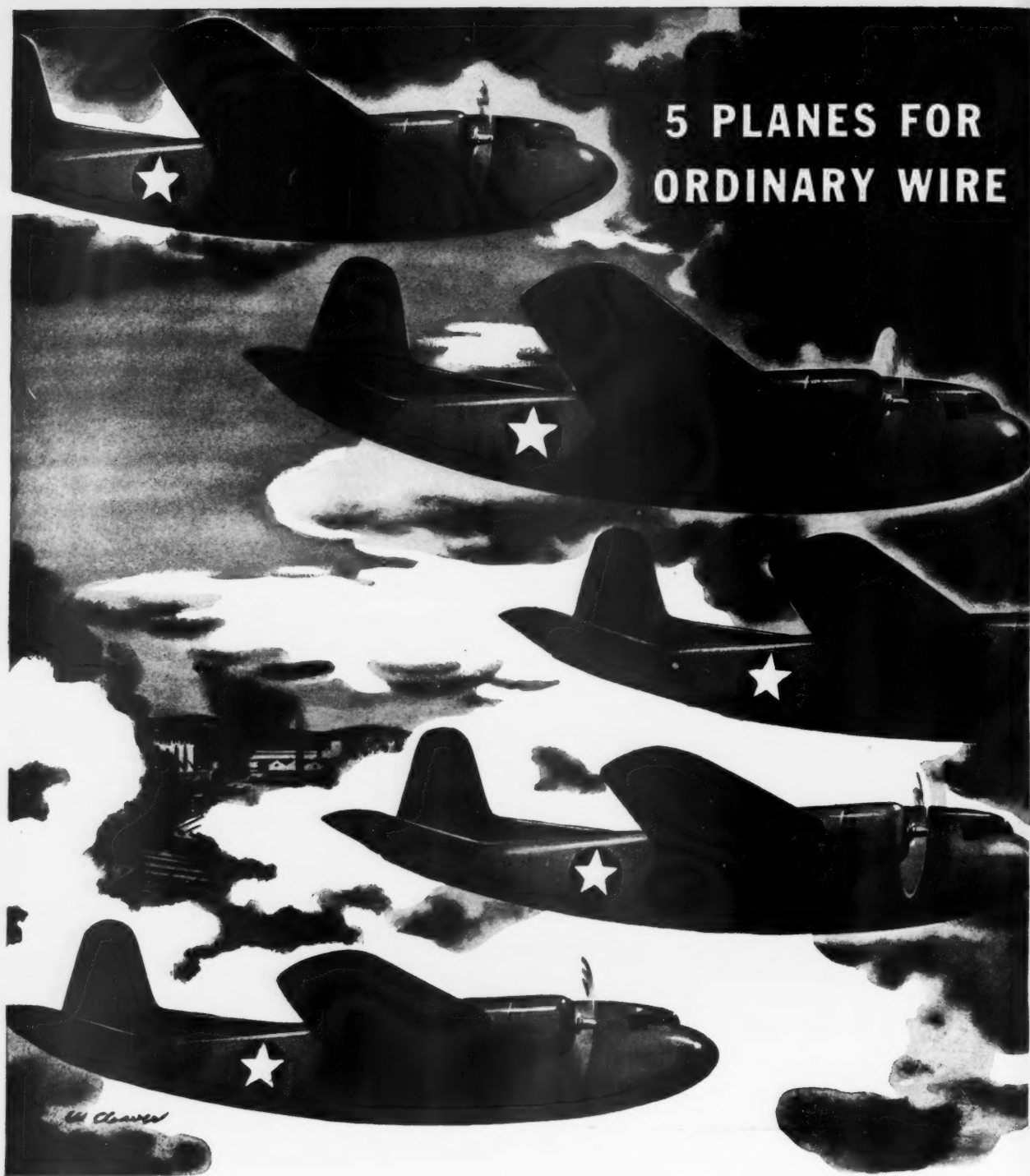
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ELECTRICAL AND AUTOMOTIVE PRODUCTS

## WAGNER INSTALLATION and SERVICE INSTRUCTIONS



Users of Wagner hydraulic braking systems, as well as every maintenance man responsible for the safe and efficient operation of overhead cranes, should have this bulletin on brake installation and service instructions. This new bulletin gives full installation and maintenance information and will be sent upon request. Write today for bulletins IU-18B and IU-20.



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ORDINARY WIRE

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## 1 PLANE FOR U. S. LAYTEX\* ASSAULT WIRE



Time is one of our best allies. The faster we can get men and material up to the front, the sooner the war will be won... our fighting men return. That's why transport planes are playing a bigger and bigger part in the Service of Supply... and why Laytex Assault Wire fits ideally into the picture of air transport.

Laytex Assault Wire—made especially for front-line service—requires only 1/5 the space in transport of ordinary communications wire. If Laytex Assault Wire had not been developed and ordinary wire had to be shipped for the same use, by air, four additional planes would be required for transport... planes needed for men,

medical supplies, food... whatever must reach the front in a hurry.

Laytex Assault Wire resists concussion and a wide range of temperature changes. It is strong, tough, will not abrade or peel excessively. Laytex is highly flexible. It is waterproof and is closely bonded to accurately-centered electrical conductors. All these qualities are the inevitable result of the unique Laytex Process which applies the compounded, purified insulation in liquid form.

Laytex Assault Wire weighs less than 30 lbs. per mile; has a breaking strength greater than 50 lbs. per conductor; a talking distance of more than five miles.

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# S RUBBER COMPANY

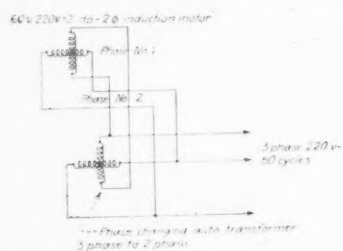
# Reader's QUIZ

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay \$5.00.

## SQUIRREL CAGE MOTOR CONNECTION

**QUESTION 99.** We have a two hp., two phase, 220-volt, 60 cycle squirrel cage induction motor. I would like to operate this motor on a 3-phase, 220-volt, 60 cycle circuit. How should this motor be connected, and what effect will it have on the motor?—R.E.P.

**A.** TO QUESTION 99. I think that the best and simplest solution is to install a phase shifting auto transformer 3 phase to 2 phase as shown on the accompanying drawing. This will



allow the motor to develop full power and run in its normal way.

To get good operation out of a 2 phase motor on 3 phase, if the change is made in the motor, usually requires complete rewiring of the stator or a costly reconnection.

The phase changing transformer was developed as a quick, economical, and expedient solution for the use of 2 phase motors on 3 phase line.—M.A.T.

**A.** TO QUESTION 99. To secure the full rated horsepower when operating on a three phase 60 cycle circuit it would be advisable to rewind the motors for three phase. However, the

T connection could be used to operate the two phase motors on a three phase circuit but of course a reduction of approximately 13 percent should be expected in horsepower developed.

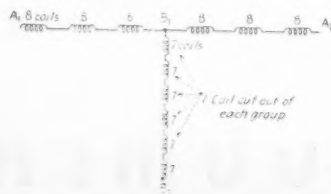
Both methods are given in detail in Dudley's "Connecting Induction Motors," Chapter IX.—B.C.M.

**A.** TO QUESTION 99. Reconnecting a 2-phase motor to operate on 3-phase is usually a very unsatisfactory arrangement, and should be avoided if possible.

First of all a 2-phase winding has about 20 percent more turns than a 3-phase motor of the same horsepower. Consequently the motor will operate as one with only 80 percent of the voltage applied. This objection can be overcome by cutting out about 20 percent of the coils to secure the proper voltage on the remaining 80 percent. These dead coils should be distributed equally throughout the winding on all phases.

Normal full load current on a 3-phase motor is about 12.5 percent higher than full load current on a similar size 2-phase motor. It follows that the horsepower rating on the 3-phase connection will have to be reduced 12.5 percent in order to keep the current density approximately the same as in the 2-phase machine; otherwise abnormal heating will result.

A makeshift arrangement is to use the Scott or T connection, as illustrated on the diagram. About 14 percent of



the coils in one of the phases are cut out in order to achieve a degree of balancing. However, it is rarely possible to get balanced current in the 3-phases no matter what scheme of connections are used, and I would suggest that the motor be rewound for 3 phase, otherwise you will get poor performance in torque, power-factor, efficiency, and heating.—L.H.

**A.** TO QUESTION 99. Twenty percent, or the nearest practical equivalent, of the coils are cut out and left dead and the motor operated on 80 percent of the 2 phase windings. Figure A shows a normal 2 phase, 6 pole series connected motor, 9 coils per group. Figure B shows the same motor with the dead coils cut out and reconnected for 3 phase. The horsepower will be about 87 percent of what it was on 2 phase.

Another method is to arrange the coils for 3 phase connection as above but

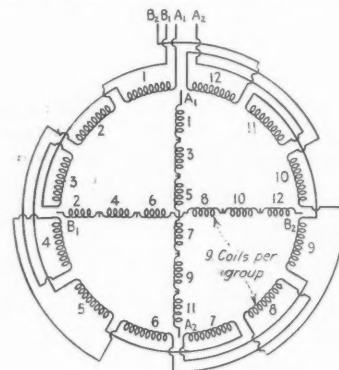


Figure A

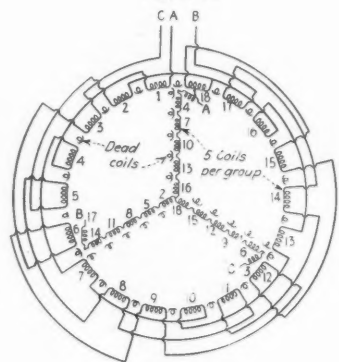


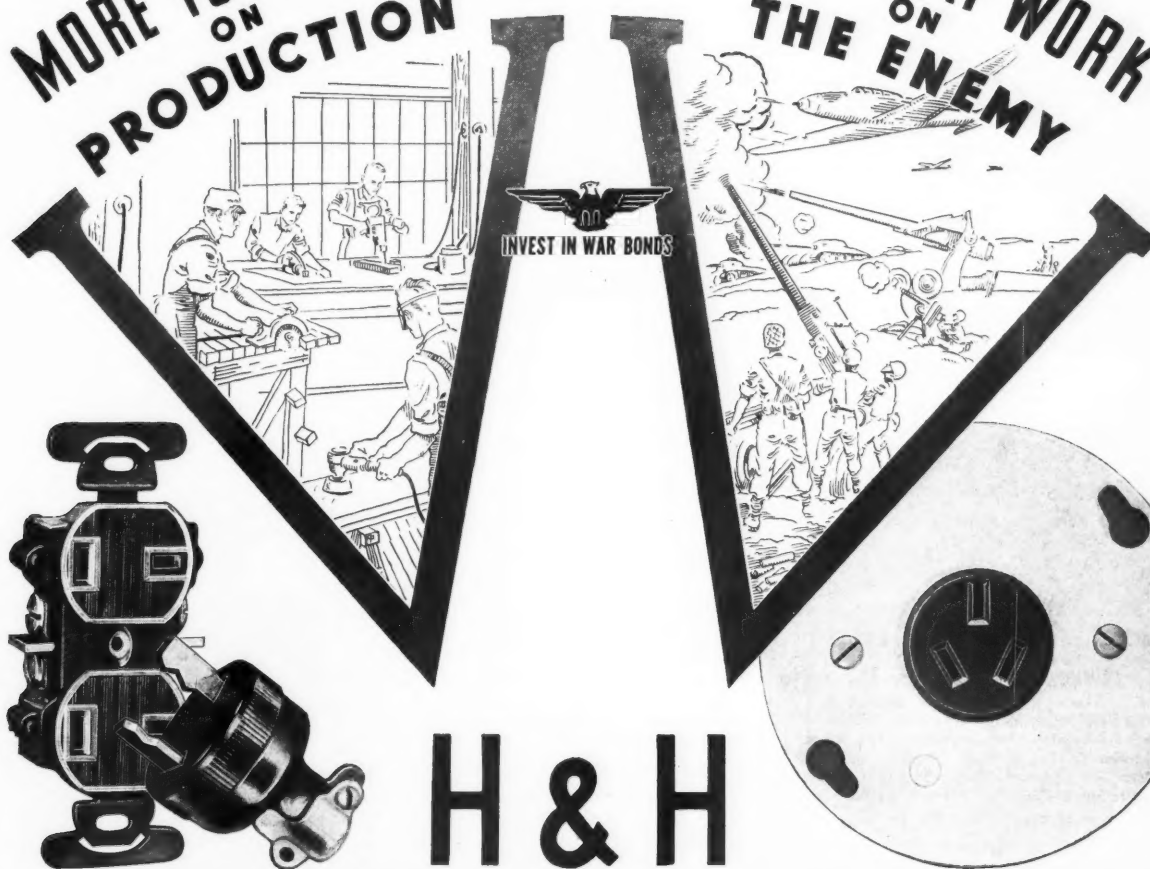
Figure B

without cutting out any of the coils. This will have the effect of operating the 3 phase motor on 80 percent of normal voltage. The starting and operating torque will be reduced and the heating increased.

The position of the phase coils, which are specially insulated to withstand the voltage between phases should be changed or the insulation between

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**MORE GUNS AT WORK  
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**H & H**

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Portable tools give more power to man-power on war-production and assembly lines. More electrical *OUTLETS* speed the plant operations which implement *all* operations on the fighting fronts.

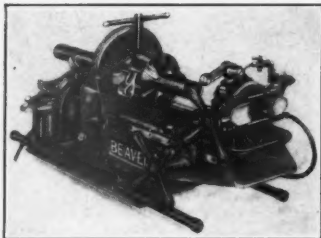
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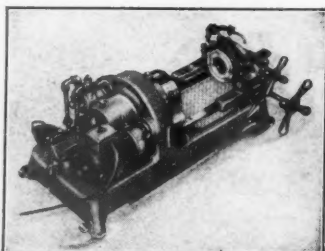
## The A-B-C of . . . Pipe and Bolt Machines!



### Beaver Model-A

A high-speed heavy-duty deluxe Pipe and Bolt Machine. Range  $\frac{1}{4}$  to 2-inch-up to 12-inch with geared tools and drive shaft. Bolts,  $\frac{1}{4}$  to 2-inch. Wt. 415 lbs.

Write for Bulletin A



### Beaver Model-B

A light-weight utility Pipe and Bolt Machine combining many features of Model-A with the easy portability of Model-C. Range  $\frac{1}{4}$  to 2-inch up to 8-inch with drive shaft and geared tools. Bolts up to 1 $\frac{1}{2}$ -inch. Weight 280 lbs.

Write for Bulletin B



### Beaver Model-C

A STURDY LITTLE POWER UNIT Converts hand pipe tools into power tools from  $\frac{1}{4}$  to 8-inch. Threads 8-inch in 6 minutes. Threads bolts up to 1 $\frac{1}{2}$ -inch. Two men can work at the same time without interference. Weight 150 lbs.

Write for Bulletin C

Write for new Tool and Machine Catalogue—Just off the press

## BEAVER PIPE TOOLS

742 Deen Ave., Warren, O.

## Reader's QUIZ

[FROM PAGE 66]

phases may become weakened and possibly breakdown.

In either case the horsepower will be reduced about 13 percent which will soon pay for a set of 3 phase coils giving the same horsepower as the original winding.—J.S.

## DRIVEN GROUNDS

**Q**UESTION 100. I have had many complaints from housewives of receiving a slight shock at kitchen sinks and lavatories when placing one hand in the water and touching the faucets with the other. Investigation with a 1000 ohm per volt meter indicated potentials as high as 42 volts and 15 milliamperes between water in bowl and faucets, which can readily be noticed with wet hands. The solution is to bond the water piping to the basin drain pipe, which is normally pretty well insulated from the faucets by the rubber gaskets between the jam nuts and the porcelain bowl and are often only electrically connected by the earth where the drain soil pipe and water service are buried. Disconnecting the electrical service to the premises has no effect on the indicated voltage at the sinks.

This condition prevails in a rural village supplied by a 3 phase, 3 wire high line with substation in the edge of town and conventional distribution system with 230—115 volt grounded neutral and some 230 volt ungrounded 3 phase secondaries. Although the village has a water system the utility company has always insisted on a driven ground at all services and will not accept N.E.C. methods of grounding to water system.

The question has come up as to whether driven grounds instead of water pipe grounds is the reason for the condition outlined above.—E.L.R.

**A.** TO QUESTION 100. In answering this question, it cannot be stated that the driven grounds are the exact cause of this trouble without more details or further information. However, more than likely this is the reason, and this condition certainly would be eliminated by changing to water pipe grounds. The fact that this condition

## PLUGS and RECEPTACLES

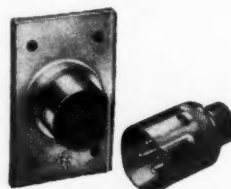
Pyle-National plug and receptacle equipment is built to stand up in heavy duty industrial service. All types have full bakelite insulation, protected contacts, and heavy steel or cast metal housings. There are styles, sizes and ratings to meet the needs of all types of portable equipment, signal and control circuits, pyrometers, extension lights, high frequency tools, welders, battery chargers, and similar equipment.



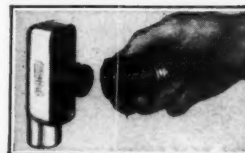
**General Purpose** plugs and receptacles: 1, 2, 3, 4, 5 poles, ratings 30, 60, 100, 200 amperes. Round prong contacts, rugged cast metal housings to withstand severe service.



**QuelArc** circuit breaking types: 2, 3, 4 wire types, ratings up to 200 amperes. Exceptional protection to contacts, for safe use as current rupturing devices.



**Triploc and Multiple Circuit** plugs and receptacles: 1, 2, 3, 4, 6, and 8 pole contact units, allowing assembly in combinations up to 32 poles. Manual and automatic release features. Ideal for portable tools, pyrometers, signal and control circuits.



**Midget Triploc**, compact, but with many exclusive heavy duty features for dependable service under severe conditions: 2, 3, 4 pole types.

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existed with the energy source removed from one house or even several houses does not necessarily mean that there couldn't be a feed-back from some other residence or some other source other than the secondary to which this house or houses were connected.

There are two accepted ways of making electrical installations safe—one by insulating and the other by grounding. It has often been said that a poor ground is worse than no ground at all. Certainly driven grounds with changeable soil conditions cannot be as safe as water pipe grounds that always have a low ohmic resistance because of its large contact with the earth and also the surrounding soil is kept moist by the water pipe itself.

The Utility Co. should not object to the use of water pipes for electrical grounding. According to the National Bureau of Standards Handbook H-32 covering the Safety Rules for Installation and Maintenance of Electric Supply and Communication Lines, it is recommended as follows:

"The protective grounding of electric circuits and equipment to water pipe systems in accordance with these rules should always be permitted, since such grounding offers the most effective protection to life and property and is not injurious to the piping systems."

Of course, the proper method of using water-pipe grounding should be followed. That is, a grounding conductor to a water pipe system should be on the street side of the water meter or on a cold water pipe of adequate current carrying capacity as near as practicable to the water-service entrance to the building or near the equipment to be grounded and shall be accessible except by special permission. If the point of attachment is not on the street side of the water meter, the water piping system should be made electrically continuous by bonding together all parts between the attachment and the pipe entrance which are liable to become disconnected, as at meters and service unions.

There have been numerous cases where the phase wire instead of the neutral has been grounded to driven grounds where this type of grounding is used and water piping is not available. This presents a very serious hazard and this condition could not exist, nor could the conditions mentioned in this question, with the proper method of water pipe grounding in use.—C.J.R.

**A.** TO QUESTION 100. You answer the question in your last paragraph, however there are several things worth mentioning from your description of this complaint.

There is evidence that your driven ground is practically no good at all in comparison to the water supply ground.

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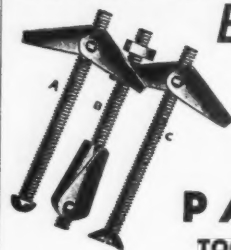


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**\* PAINE \***  
**FASTENING  
and HANGING DEVICES**

## Reader's QUIZ

[FROM PAGE 69]

There is evidence that your soil is not suitable for a driven ground, and there is a great amount of danger in this type of trouble both from personal and property standpoints.

There are several things that might happen that would raise the potential between faucet and sink to a dangerous voltage, such as: breakdown of insulation in distribution transformer, primary conductor becoming in contact with secondary conductor, or during lightning. This condition can safely be corrected by improving your driven ground, however this might be very difficult or impossible.

I think if it was my problem I would bond the driven ground and the water pipe together using No. 8 wire, and approved ground clamps, if your utility company doesn't object. They probably have a good reason for not wanting to depend on a water pipe ground only, and would not object where both were used. This is virtually what you have been doing except it should not be bonded at the kitchen sink, but should come direct from the service switch point.—R.T.W.

**A.** TO QUESTION 100. Undoubtedly, the use of driven grounds at all services instead of grounding to the water main, which everyone connected with the electrical industry knows has the lowest ohmic resistance to absolute ground, contributes materially to this condition. I have seen this same condition occur on industrial jobs. Not long ago we found a difference in potential between two steel frame structures of eighteen volts. This was caused by the fact that one of the structures had a more positive or absolute ground, while the other structure ground was of a higher resistance. As everyone knows, electricity always seeks the ground of lowest resistance. The condition described in the question is caused by transit currents seeking a ground of lowest resistance.—D.E.O.

**A.** TO QUESTION 100. The condition of voltage potential between faucet and water in basin may be due to low earth conductivity in the vicinity of the homes which have complaints.

It is possible that grounding of equipment at the substation in the village places a condensive charge on the (nearby) metallic water line through conducting earth. At the point where this water line enters poorly conducting ground, another condenser, in effect, is



Laboring under terrific strain, engineers are constantly striving to improve electrical units so that they will perform more efficiently and meet diversified needs. Minute details in the blueprints are thoroughly checked and carried out in production.

As units must comply with specifications, and pass rigid inspections, why not follow through by specifying DOLPH'S Insulating Varnishes? After all, your electrical units are no better than the varnish which protects them.

The DOLPH Laboratories are constantly developing new insulating varnishes to meet the exacting needs of improved electrical units. The answer to your insulating problem may be found in the DOLPH Laboratories. There are no obligations, so why not inquire?

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set up between the water line and the metallic portion of the drain line (which, of course, is in contact with the water in the basin); thus producing the voltage potential between the faucet and the water in the basin.

The possibility of static (friction) charge or indirect connection to the secondary system may be discounted.

Water pipe-grounds, if made common practice in the village, would probably alleviate if not clear the condition by equalizing ground potential.—E.S.

## INSULATION RESISTANCE

**Q**UESTION 101. When testing the insulation of an electric motor with an ohmmeter, what should be the minimum reading in ohms or megohms for the different voltages 110, 220, and 440 volts a.c. or 115 and 230 volts d.c.?—F.F.

**A.** TO QUESTION 101. According to the standards of the American Institute of Electrical Engineers the minimum value of insulation resistance of a machine at its operating temperature is given by the following formula:

Insulation Resistance in Megohms =  $\frac{\text{Rated voltage}}{\text{Rating in kw.} + 1000 \text{ or rating in kva.} + 1000}$

For small machines it will be noticed that the resistance in megohms will be approximately 1/1000 of the rated voltage. For example with a 220 volt 10 horsepower motor we have:

$$\frac{220}{7.5 \text{ kw.} + 1000} = .2183 \text{ Megohms}$$

$$\frac{220}{\left(\frac{7.5 \text{ kw.}}{.85 \text{ P. F.}}\right) \text{ kva.} + 1000} = \frac{220}{1008.8} = .2181 \text{ Megohms}$$

For 100 kw. or kva. the resistance will be 10 percent less than E/1000 and for 1000 kw. or kva. 50 percent less.

For the values indicated the minimum readings should be as shown:

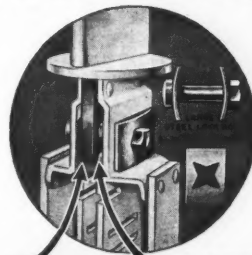
Voltage	Megohms
110 a.c.	.11
220 a.c.	.22
440 a.c.	.44
115 d.c.	.115
230 d.c.	.23

—J.E.W.

**A.** TO QUESTION 101. There is no definite rule as to the resistance to be maintained between the motor windings and ground. We have over 900 motors and I try to keep the insulation resistance above 2 megs. for all types and voltages. Any motor that tests above 2 megs. is in fair condition but may still become grounded very easily. Most of our motors test above 90 megohms. The most important thing to watch is that the motor maintains the same resistance over a period of



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### Keep Motors Humming

- End Over-Heating
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**National Electric**  
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Pittsburgh, Pa.

## Reader's QUIZ

[FROM PAGE 71]

time. If the test goes up and down, this indicates that the insulation is weak and moisture, iron dust or some other substance is causing leakage. A good coating of some good insulating varnish will probably cure the trouble.—C.E.S.

**A.** TO QUESTION 101. There seems to be no standard of safety concerning the value of insulation resistance. The question of whether or not a piece of apparatus is safe from this standpoint is usually determined by a high potential—usually this test being twice normal voltage plus 1000. And if no break down occurs the insulation is considered satisfactory. However, there does seem to be some grounds for measuring the insulation resistance, and various authorities state that these values should be 1000 ohms per volt to 1,000,000 ohms per volt which is quite a variation. So in answer to F.F.'s question the minimum readings should be:

110 V. — 110,000 ohms  
220 V. — 220,000 ohms  
440 V. — 440,000 ohms

No definite distinction need be made for d.c. but in case one wishes to have the d.c. voltages on the same basis as the above a.c., the d.c. voltages should be multiplied by .707.—M.T.F.

### Can You ANSWER these QUESTIONS?

**QUESTION D4**—How can a multiple lead covered conductor cable be tested in a man hole where many cables are carrying high voltage, before cutting said cable for changeover?—E.C.C.

**QUESTION D5**—I would like a wiring diagram for the following group of motors: We have a group of eight 220 volt, 3 phase, 60 cycle motors we want to interlock. Motors No. 1 and 2 are controlled by manually operated starters. Motors No. 3 to 8 have magnetic starters.

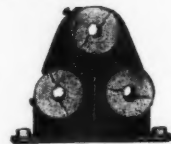
I would like to arrange the control so that motor No. 8 must start before any of the motors No. 1 to 7 can be started.

If any of the motors No. 1 to 7 should stop all except No. 8 must stop. If No. 8 should stop all others must stop.

Motors No. 6 to 8 are operated by start and stop buttons. The nub of this problem is, of course, the operation of motors 1 and 2 which have manual starters.—R.E.P.

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YOUR ANSWER BY AUGUST 1**

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For complete details see pages 8, 9, and 10 of the IWI BLUE CATALOG. If you do not have it, write today.

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# Debunking *Globaloney*







## ABOUT "UNIVERSAL" OVERLOAD RELAYS

There is no universal overload relay which will provide complete motor protection under all extremes of temperature found on the globe. A variety of thermal elements is needed for universal overload protection.

Therefore a simple type of relay, like the Allen-Bradley resisto-therm, will satisfy 98% of industrial requirements. Only where a starter is subjected to very wide temperature changes does the universal (compensated) relay offer tangible advantages. Such installations are not an everyday problem . . . hence, the relay with the fewest parts . . . like the A-B resisto-therm . . . is the ideal overload relay.

The following table presents a picture of overload relay performance under various atmospheric temperature conditions. Whether you use resisto-therm or "universal" relays, you must analyze installation conditions and select the correct thermal element for reliable motor protection.

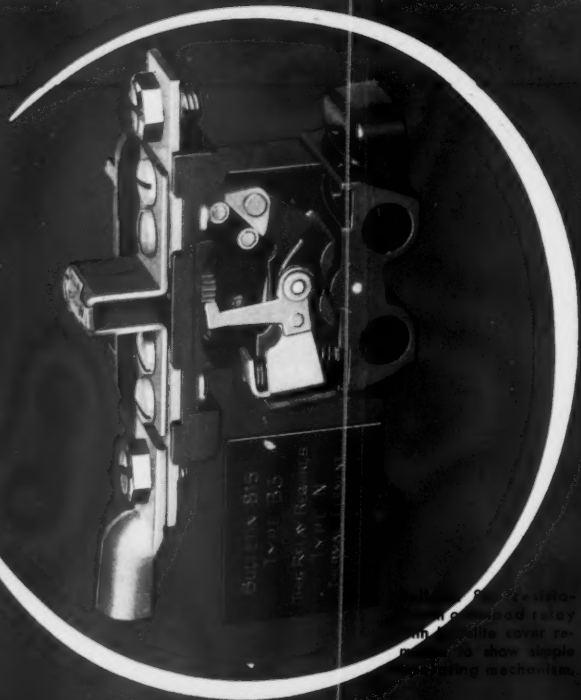
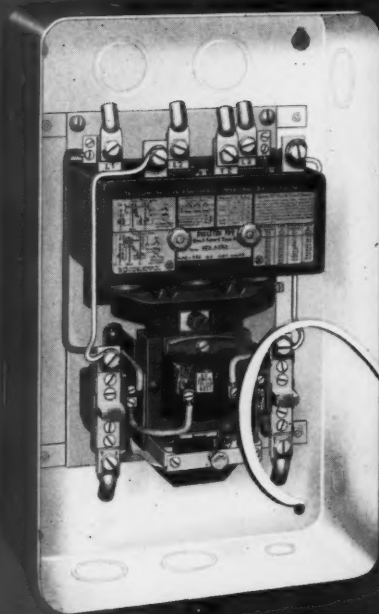
### HOW TO SELECT THE OVERLOAD RELAY FOR BEST PROTECTION UNDER VARIOUS TEMPERATURE CONDITIONS

		 
Atmospheric temperature at motor	Atmospheric temperature at starter	Relay
NORMAL	NORMAL	Specify resisto-therm relay because of its simplicity. "Universal" type contributes nothing toward improved protection.
Considerably ABOVE NORMAL (A very common condition)	NORMAL	Specify resisto-therm relay. "Universal" relay may permit motor to reach a dangerous temperature, because it operates on current only and does not consider effect of high atmospheric temperature in which motor is operating.
Considerably BELOW NORMAL	NORMAL	Specify resisto-therm relay because it permits motor to carry any safe load but protects it against overheating. "Universal" relay, operating on current only, will not permit motor to do a wartime job.

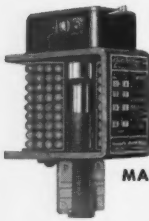
**ALLEN-BRADLEY**  
**OVERLOAD RELAYS**  
QUALITY

# PROTECT YOUR MOTORS

## with simple but reliable relays

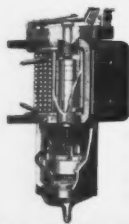


### FOR HIGHER CAPACITIES



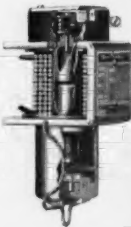
#### INDUCTO-THERM TYPE

Cross-section of Bulletin 820 overload relay, adjustable over a wide range of tripping values. Used with the larger motor starters.



#### COMBINATION MAGNETIC INDUCTO- THERM TYPE

Bulletin 821 overload relay combines advantages of magnetic and inducto-therm relays for high tension starters.



#### MAGNETIC TYPE

Bulletin 810 overload relay, showing dashpot construction, is ideal where motors are liable to stall.

The thermal overload relay, used with all Allen-Bradley solenoid starters, is of remarkably simple design.

This relay will provide reliable motor protection under all operating conditions requiring only that the heater element be the correct one for the specific installation.

Allen-Bradley resists-therm relay operates on the soldered contact principle. The relay contact is soldered to a stem surrounded by a thermal element. A sustained overload on the motor heats up the thermal element which melts the eutectic solder. The contact is then free to flip and opens the silver alloy, double break relay contacts. This opens the coil circuit of the starter and disconnects the motor from the line.

Give your motor reliable overload protection by installing Allen-Bradley solenoid type starters. They all have two resists-therm relays. You get not only safe overload protection, but millions of trouble-free starter operations. The double break silver alloy contacts never need any maintenance. There are no pins, pivots, hinges, flexible fingers, or bearings to break, stick, or corrode. Write today for Bulletin 209.

Allen-Bradley Company, 1516 S. Second St., Milwaukee, Wis.

# ALLEN-BRADLEY

## SOLENOID MOTOR CONTROL



# Motor Shops

## BAKING INSULATION

An insulation bake oven designed and built twenty years ago by C. C. Ingram of Schulz and Ingram, Inc., a New Haven, Conn., repair shop is today operating at top efficiency and full capacity. Since the very first day of operation there has been seldom a time when the oven was not in use.

The frame was built of angle and channel iron with galvanized sheet steel



**TEMPERATURE CHART** for continuous recording can be seen above this 4 kw. baking oven. Mercoid switch for temperature control and time clock switch are mounted on right side of oven.

walls filled with 2-inch air cell asbestos. The heat loss through the walls is negligible. The heating elements were installed across the bottom of the two channel iron tracks. Fresh air is admitted through vents at the bottom where it passes directly over the units quickly heating the air. The hot gases pass out through a flue at the top where they are conducted to the outside. Good ventilation is essential to proper baking in order to obtain proper oxidation for thorough drying.

Eight 500 watt, 110 volt units are used, two each in series across 220 volts,

single phase, giving the oven a rating of 4 kw. Close temperature regulation is obtained through the use of a thermocouple and mercoid switch. A time clock is also used for "on" or "off" control during the night or whenever unattended. A permanent temperature chart records continuously to insure quality baking. The charts show that the oven can be held at any predetermined degree of temperature without any variation whatsoever.

The oven has a capacity for a 100-hp. 1800-r.p.m. motor although the majority of their larger jobs involve 50-hp., 720-r.p.m. and 900-r.p.m. motors.

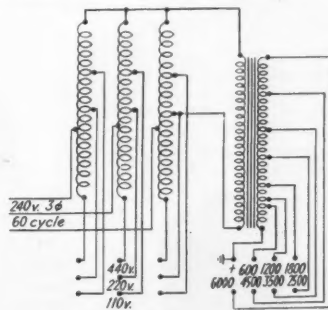
Ingram does not favor using an air-drying varnish nor a linseed oil base baking varnish. By using synthetic baking varnish he can cut his baking time considerably. For a three dip treatment, he bakes 2 hours on the first dip, 2 hours on the second dip and from 8 to 10 hours on the third dip for a total of 12 to 14 hours. Baking temperature is held at 270 deg. F. In contrast, the ordinary linseed oil baking varnish takes from 14 to 16 hours per dip at 225 deg. F. for a total of 42 to 46 hours. Although the cost of synthetic varnish is considerably more (about five times as much per gallon)

Ingram prefers it and claims that the resulting job is much better in its elastic and resistant properties and so far as life and insulation tests are concerned it is even better than the original factory job.

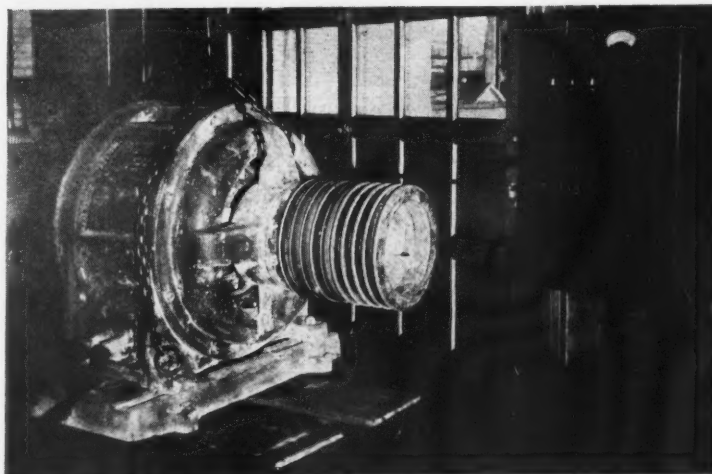
Leads are connected and brought out so that the tap joints may benefit by the dipping and baking. However in order to keep the leads from becoming stiff a flexibilizing compound is applied after each dip just prior to baking. The leads could, of course, be attached after the baking is done but in so doing the joints would not have the advantage of being baked.

## MOTOR TEST PANEL

Good and readily accessible motor test facilities are essential to good motor shop practice. F. J. Skonier, manager of the Keystone Armature Works in Altoona, Pa., has designed and built a test panel utilizing an auto transformer to obtain 110 volt, 220 volt or 440 volt, 3 phase for test runs and six voltages



**CIRCUIT DIAGRAM** of autotransformer connections which are brought to test panel receptacles.



**TEST RUN** about to be made on a 100 hp., 440 volt motor prior to repairing.

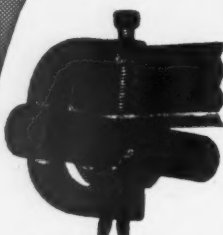
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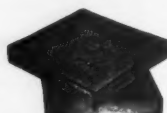
**#470 "BULL DOG"**  
PIPE or CONDUIT HANGER  
High quality yet economical. High grade malleable iron. Sturdy and strong. For hanging 1/2", 3/4" or 1" pipe to 3/4" steel beams. As a ground clamp will take copper wire No. 8 to 4.



**#150 BOX with #270 NOZZLE**  
Latrobe adjustable watertight floor box—Underwriters' approved—suitable for installation in concrete floor—Tops easily adjusted.



**"BULL DOG"**  
INSULATOR SUPPORT  
Malleable iron of high tensile strength for fastening porcelain and glass insulators to exposed steel framework.



**"KEYSTONE FISH WIRE"**  
High grade flat steel wire, tempered. Ten sizes. 100 ft., 150, and 200 ft. coils. Special lengths if required.



**#284 NOZZLE with #200 COVER PLATE**  
Double Duplex Receptacle with 1/2 inch brass pipe extension. Also furnished with 3/4 inch pipe extension. Highly regarded.



**#625 LATROBE CONDUIT BENDER**  
Made of "TUF-A-LOY" steel. Reversible jaw. Internally threaded socket; guaranteed against breakage. Will not slip or kink conduit.



DURABLE

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**FULLMAN MANUFACTURING CO.**  
LATROBE . . . PENNSYLVANIA

*Motor Shops*

(FROM PAGE 75)

from 600 volts to 6,000 volts single phase for high pot test.

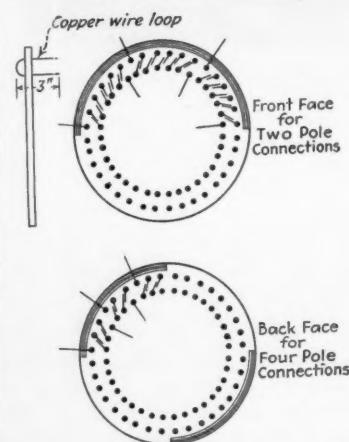
Provisions have been made on the board for obtaining the various voltages by the use of plug-in type leads. All receptacles are clearly marked. The leads are provided with wooden handled plugs on one end and large clips on the other. The clips are protected by heavy rubber sleeves.

Special heavily insulated leads are used for the high pot test. The operator, as an added precaution, uses rubber gloves when applying high voltages. All motors are given a test upon coming into the shop. After repairs have been made a standard test run is given the motor plus required high voltage tests.

### DUMMY STATOR DEMONSTRATION BOARD

Learning how to make stator connections by experience requires considerable practice and time. And a wound stator does not readily lend itself to experimental connecting without damage to the coils or coil leads. How then can groups of inexperienced help coming into the shops now be taught this important phase of motor service work?

Frank Willey, Willey-Wray Electric Co., Cincinnati, and lead man of the NISA Employee Training Program, solved the problem by constructing a set of dummy stator boards for demonstration purposes. The boards consist of 3/8-in. plywood discs with holes drilled on a radial line and in concentric circles

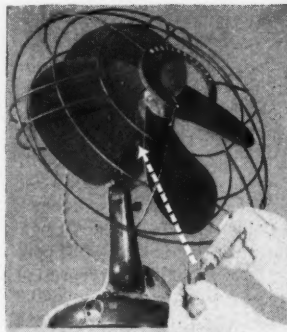


**DOUBLE-FACE DUMMY** board is used to demonstrate two and four pole stator connections, this model is 18-inches in diameter and has 36 slots (boles). (Fig. 1)

# Make your Fans Last..

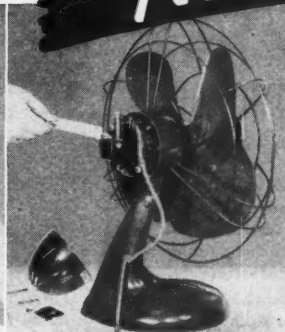
## DO THESE THINGS

### 1 LUBRICATE

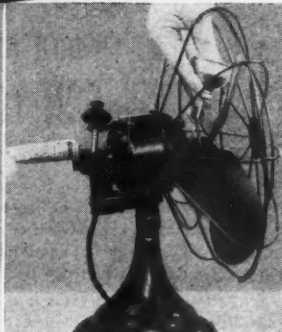


**STREAMLINE TYPE**

Oil or grease front bearing.

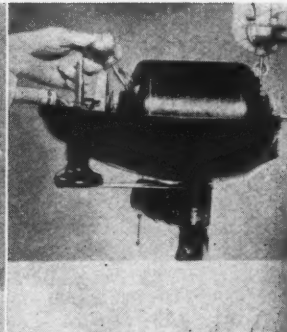


Grease gears and rear bearing.



**CONVENTIONAL TYPE**

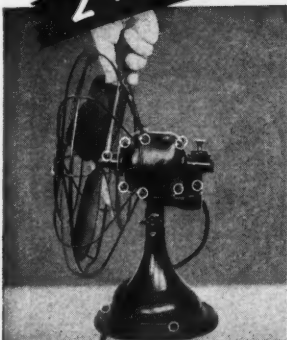
Grease oscillating gears and rear bearing. Oil or grease front bearing.



**LARGE CIRCULATOR TYPE**

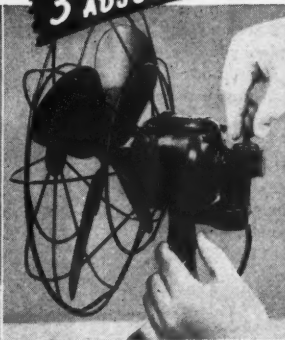
Oil motor at both ends. Grease the oscillating gear.

### 2 TIGHTEN



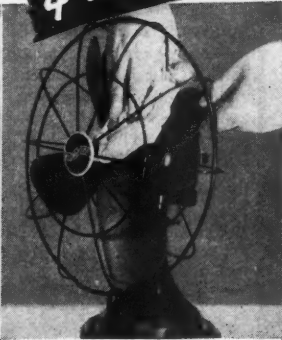
Tighten set screw in fan blade hub. Also tighten screws or nuts holding fan guard, motor case, and other parts.

### 3 TEST ADJUSTMENTS



Always loosen clamping screws for directional adjustment. Never force by twisting guard.

### 4 CLEAN BLADES

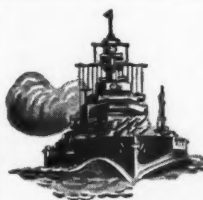


Accumulated dirt and dust cause blade unbalance, vibration and bearing wear.

### 5 CHECK CORD



Make sure wires are not loose, particularly in plug end. When turning fan off, use switch instead of jerking out plug with cord.



### FULL SPEED AHEAD

Westinghouse is now producing more fans than ever—all for ship-board use by the Navy and Maritime Service. With this experience added to an already outstanding record, Westinghouse postwar fans will set a new and higher standard of value.

Always follow the manufacturer's printed instructions. If not at hand, obtain from distributor or manufacturer. Medium-grade machine oil is generally recommended for fans. The distributor or manufacturer will advise what grease to use. Grease for Westinghouse fans can be obtained through your nearest Westinghouse distributor.

# Westinghouse *Long-Life* Fans



*To All Users of Motor Control:*

## HOW TO BUY FOR TODAY and be READY FOR TOMORROW

The motor control you buy today can be a wise investment that will better prepare your plant for peacetime reconversion . . . simply *insist on UNITROL*, the unitized and interchangeable control equipment that can be "converted" at will!

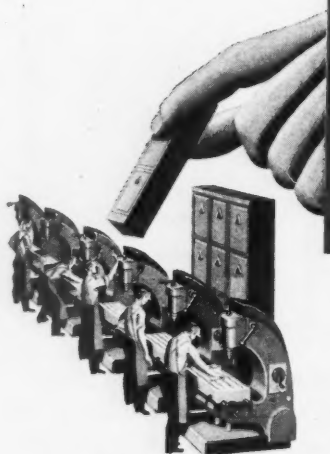
*Here's why UNITROL is a sensible buy today.* It lets you get 2 to 3 times as much control into the same space, lets you arrange your plant's motor control to conform to individual needs, lets you take advantage of "odds and ends" of space and meet your particular manpower requirements. It installs fast, needing only to be electrically connected.

*Here's why UNITROL is a good investment for tomorrow.* UNITROL is like your sectionalized filing cabinets. Each control unit can be removed easily and quickly, placed in some other compartment, or replaced. Entire sections can be shifted or removed. The complete plant-serving UNITROL control center can be reshaped, reorganized or expanded as your post-war operations demand.

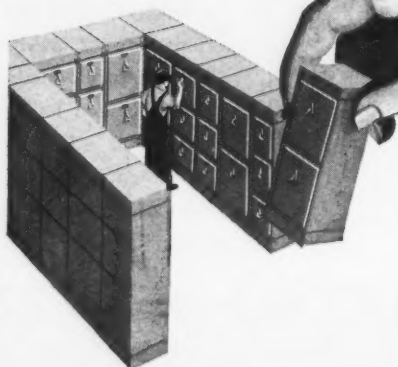
Before you buy any motor control now, send for the 36-page UNITROL book. It's free. Write today. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin. Associate: Canadian Cutler-Hammer, Ltd., Toronto, Ontario.



Multiple control can be housed in a UNITROL Section alongside the machine it serves.



Control for a machine group or department can be centralized in nearby unused space.



Complete plant-serving UNITROL Control Center can be shaped to conform to any available space . . . in straight line, L-shape, U-shape or combination.

Copyright, 1943—Cutler-Hammer, Inc.

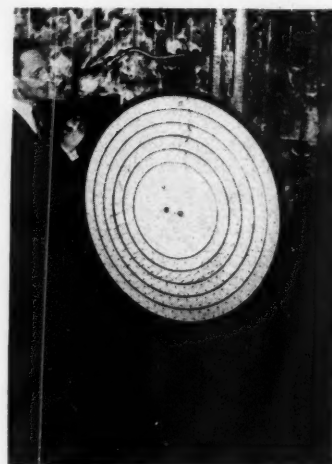
*Motor Shops*

[FROM PAGE 76]

to represent stator slots. The individual coil is represented by a wire loop, about six inches long and bent in a "U" shape with the two ends protruding through the holes. A snug fit keeps these loops from slipping back during the demonstration. Number 15 or 16 bare, enamel or double enamel wire is used on the small 18-inch (36 slot) model for two and four pole stator demonstrations (See Fig. 1). On the larger model (up to 60 slots) for six and eight pole demonstrations, number 12 or 13 wire works well (See photo).

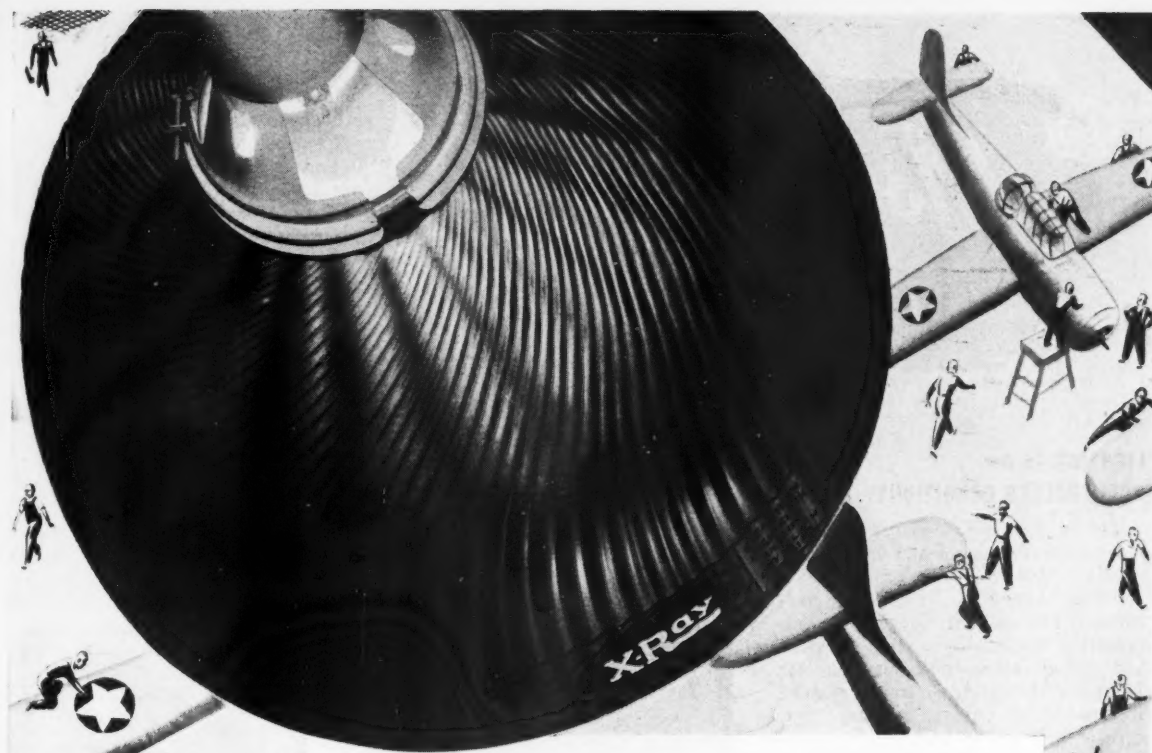
On the face of the small model (See Fig. 1), a half circle is painted black to indicate pole span of a two pole stator. The back face has two opposite quarter circles painted to represent a four pole stator. The large model shown in the accompanying photo has 24, 36, 48, 54 and 60 slots to demonstrate other types of stators.

Though not the case in an actual stator, the inside and outside leads of each coil are on a radial line to help the student identify particular coil leads. Stub connections are not twisted, merely



**LARGE DUMMY STATOR** mounted on a tripod stand and complete with gooseneck fixture is exhibited by its designer, Frank Willey, at the recent NISA War Conference in Cincinnati.

bent down side by side, to preserve the wire loop for future demonstrations. Long wire loops are substituted for the short ones to demonstrate jumper connections from one coil group to another. Phase jumpers can be covered with colored sleeving to identify them to the student. Two and three phase (Y and Delta)—both parallel and series connections—can readily be shown. Dummy stators of this type are a valuable teaching aid for small or large groups.



## IT'S ALL DONE WITH MIRRORS

Yes, Curtis makes use of Silver Mirror Glass as the reflecting surface for "X-Ray" Industrial Lighting Units. War plants throughout the country find these units the ideal equipment for increasing production, improving workmanship and reducing spoilage.

"X-Ray" Silver Mirror Reflector Units are outstandingly efficient and satisfactory from a lighting standpoint and are also very economical because of ease of installation, low maintenance cost and long life. They contain very little iron and steel and are well within government requirements.

Various sizes and types are available for incandescent lamps up to 1500-watts, and for the 400-watt Mercury Vapor lamp.

"X-Ray" Silver Mirror Reflector Units are carried in stock for immediate delivery. Write us today for complete catalog information and prices, or get in touch with your local Curtis representative.

**CURTIS LIGHTING, INC.**  
6135 W. 65TH STREET . . . CHICAGO

# Modern Lighting

## LIGHTING IN A "CONTROLLED CONDITIONS" PLANT

One of the world's first windowless factories was designed and built by the Austin Company for the Simonds Saw and Steel Company. This single, five-acre windowless room is equipped with acoustical materials on the sidewalls and ceiling; air conditioning, plus air filters and ventilating controls that make it possible to remove grinding dust, furnace heat and gases at their source. Inside the four walls of this plant, eight parallel production lines were laid out, each entirely self-contained, to produce all the items the company made. Space formerly required was 17½ acres (old plants.)

The control of sound, atmosphere and light made it possible to locate all heat treating, forging, grinding, smithing, pointing and sharpening equipment where it belonged in each production line. Instead of traveling a 3280-foot circuitous route, as under the old system, individual products now move only 1050 feet from raw stock to finished stock bins without a single detour.

Lighting was one of the important "conditions" in the design of this plant. Modified Cooper-Hewitt fluorescent lamps in porcelain enameled reflectors were installed for general lighting throughout the plant. The original blue-white lamps have been replaced with daylight white which are more pleasing to female workers in the plant. By systematic maintenance and a thorough cleaning of the lighting units every six months, the plant engineer reports that, after four years of operation, they still maintain an average illumination intensity of 25 foot-candles—practically what the system was designed to produce. Average lamp life now is 4800 hours compared to the original life of 3400 to 3800 hours when first installed.

Equipment maintenance has been reduced and lighting efficiencies maintained by painting machines in orange-yellow and furnace equipment aluminum.

One unusual application of fluores-

cent lighting is in the production line area where smithing operations are performed. Previously this had to be done in a part of the plant where natural north light was available. Now, however, this is done with equal accuracy right in the production line by using

## RECESSED FIXTURES ELIMINATE GLARE

For the highly polished surfaces of bowling alleys, now such popular recreation spots in all of the war-production centers, the well-designed,



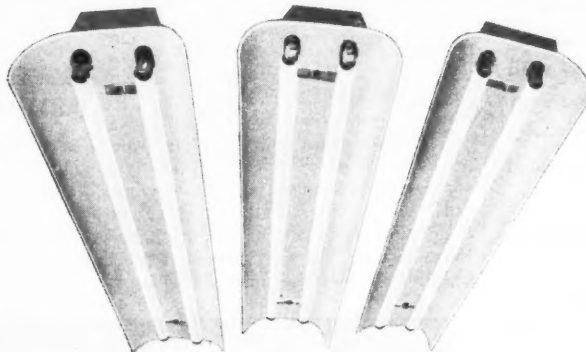
**MAN-MADE NORTH LIGHT** permits switching operations to take place right in the production line. Canopied booths with fluorescent tubes behind opaque glass walls produce the required illumination.



**PARALLEL PRODUCTION LINES** operate under a canopy of fluorescent lighting in this 5-acre windowless "controlled conditions" plant. Each line is entirely self-contained incorporating all processes from raw material to finished product.



## THROWING MORE LIGHT ON THE WORLD'S BIGGEST JOB



**T**HE USE of metal for fluorescent reflectors has been restricted for some time . . . critically needed steel must be saved for ships, tanks and guns . . . and yet lights today are glowing in gigantic war-production plants as American industry battles the biggest job in the world.

This fact pays high tribute to the inventive genius and research of the fluorescent lighting industry . . . to

the men who looked and worked ahead and had ready, when it was needed most, an efficient replacement for steel in the manufacture of fixture reflectors.

The Masonite Corporation is proud to have had the privilege of working with the electrical industry in the development of a special non-metallic reflector hardboard.

Many have found the new

Masonite\* Reflector Board presents definite advantages for war-plant lighting. Reflectors made from this rugged but light-weight material are easy to handle and cut shipping costs . . . take fine finishes, assuring a high reflection factor . . . are both water and heat resistant. For more detailed information, please write Masonite Corporation, 111 W. Washington St., Chicago, Ill.



# MASONITE CORPORATION

TRADE-MARK REG. U. S. PAT. OFF. "MASONITE" IDENTIFIES ALL PRODUCTS MARKETING BY MASONITE CORPORATION. COPYRIGHT 1943, MASONITE CORP.


*Electrical Contracting, July 1943*



**"I sure am, Pop—  
and it was  
EASIER!"**

When you use Kondu fittings, the job LOOKS better because it IS better. Kondu is the easiest fitting to tighten up in perfect alignment.

And you have no trouble at all installing Kondu close to corners, or up against girders and partitions.

**Thin-wall or Thick-wall conduit** can be attached at any outlet of any Kondu fitting—with either a Threadless or Threaded connection.

**Every Kondu box is a union,** and can be taken out of the line without disturbing conduit.

**Vibration-Proof,** Kondu holds permanently tight. Practically unbreakable . . . 100% re-usable. Roomy enough for all splices.

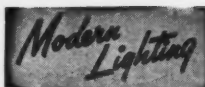
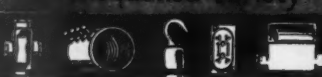
Write for the Kondu Catalog.

**KONDU CORPORATION**  
Erie, Pa.

**KONDU**



Threadless Fitting Line  
Unequaled Variety



[FROM PAGE 80]

fluorescent-lighted installation gives just about ideal diffusion of illumination when the light sources are concealed behind baffles in the ceiling. A good example is that in the recently opened Downtown Bowl in San Francisco, where 40 alleys on a two-floor arrangement embody the principles of baffle shielding in lighting design.

To serve the patronage on a 24-hour a day basis because war workers on swing shifts come in at all hours, the electrical engineer, Lyle E. Patton and the electrical contractor, Pacific Electrical and Mechanical Co., of San Francisco, working with the lighting designer, William Haluk, of California Electrical Supply Co., produced an unusual installation totaling 42 kw. of connected load.

All public space is lighted by 40-watt, 3,500-deg. white fluorescent sources. The lamps are usually in pairs with very simple reflectors. Alley lighting and foot-candle intensities are as follows:

Area	Lighting Fixture	No. of 40-Watt Lamps	Foot-Candles
Approach	Open ceiling (ornamental)	2	20
Alley	In pairs (in coves)	10	35
Pin space	Reflector (over pins)	1	150

Over the alleys the light units are located in ceiling coves which act as a series of baffles and hide the units themselves from view. Light for the pin space is located under a mask over the pins. The counter and desk space for floor supervisors and a soft drink and lunch counter likewise have fluorescent lighting as does the audience room of

the broadcasting station. Office space, rest and store rooms, entrance way and ceiling of the marquee are lighted by incandescents, usually three 60-watt lamps in flat ceiling bowls. The bar is lighted by a linear fluorescent source enclosed in ribbed glass. Before the dimout the facade of the building was lighted by 817 ft. of 15-mm., 30-Ma. fluorescent tubing and flashed by a ten-point flasher.

A refinement in the design is that each alley is equipped with a photoelectric cell and suitable light source projecting a pencil beam of light across the alley at the foul line. Interrupting this beam, the circuit is energized and a buzzer with flashing red signal light mounted on the face of the pin mask records the foul.

Above each set of alleys is a Tel-E-Score upon which is projected in large scale the score sheet below.

Room temperature is controlled and air changed by a ventilating system. PBX telephones and an R.C.A. public address system furnish the communication service.

Another unusual feature is an operating and audience room for broadcasting and wire connections. Air time is allotted to the bowl by the two stations KGO and KSAN. The premises were fitted with complete facilities for black-out to insure continuous operation.

## COMMERCIAL FLUORESCENT INSTALLATION

An outstanding commercial installation of fluorescent lighting in Canada has been made by Cunningham Drug Stores, Limited, at Robson and Granville, Vancouver. A maintained intensity of 50 foot-candles is provided. This represents an increase to 333 percent in



**EVEN, HIGH INTENSITY** lighting over the entire bowling alleys is provided by fluorescent fixtures mounted in coves behind the recessed ceiling sections, eliminating reflected glare in the eyes of the bowler.

# MITCHELITE

## SHOWS THE WAY

**FIRST** with Steel-Saving Design, using a minimum of steel to comply with latest WPB requirements.

**FIRST** with New-Type "Rigid-Spine" Wireway Channel that Simplifies Wiring and Mounting for Continuous Rows.

**FIRST** with Simplified End-Piece for Easy Access to Starters and Sockets Without Disturbing Lamps.

**FIRST** with "Underslung" Ballast located on "Outside"—Cooler operation results in longer life.

**FIRST** with "Easy-Fit" Coupler for Better, Easier End-to-End Mounting. Simpler—quicker to install.

PATENT APPLIED FOR

**MITCHELL**  
FLUORESCENT



Get Free MITCHELITE Catalog No. 400 from your MITCHELL DISTRIBUTOR, or write to

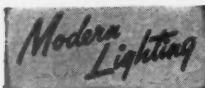


### 4 MITCHELITE Models Answer Every Lighting Need

You can get MITCHELITE lighting in 2-40 watt and 3-40 watt units, 2-100 watt unit, and a 2-section unit for four 100-watt lamps which operates with only one ballast.

Each model is so flexible it can be used for both individual and continuous row lighting—for surface or suspension mounting.

**MITCHELL Manufacturing Co. • 2525 North Clybourn Ave., Chicago, Ill.**



[FROM PAGE 82]

intensity at the expenditure of 33 percent more kilowatts.

Before modernization, the store, which is 35 feet long and 23 feet wide, had a ceiling height of 14 feet and the lighting equipment consisted of six incandescent 500-watt chain-suspended opal glass units which gave an average intensity of approximately 15 foot-candles in service. The total power output was 300 watts giving slightly more than 4 foot-candles per watt per square foot of floor space.

Now, after modernization which included a reduction in ceiling height to 10 feet 8 inches and the installation of 40 twin 40-watt ceiling-mounted fluorescent units, slightly more than 50 foot-candles of maintained illumination is provided. The fixtures are installed in five continuous rows of eight units each, with the rows on 4½-foot centers. The total power input, including ballasts, is 4000 watts, so that the foot-candles resulting from each watt per square foot of floor space is 10. This is exactly 2½ times the efficiency of the old incandescent system.

The intensity of 50 foot-candles referred to was the average measured intensity at counter level after a period of over four months during which the lamps were burned 15 hours per day. Initial light meter readings taken shortly after the installation had been completed, were of course, considerably

higher, being of the order of 80 to 85 foot-candles.

The fixtures, manufactured by the Lighting Materials Co., of Winnipeg have both lateral and longitudinal louvres which reduce the fixture brightness and shield the eyes from direct view of the bare fluorescent lamps. The prismatic glass side panels of each unit redirect the upward light to help in obtaining uniform ceiling illumination and assist in creating pleasant, comfortable lighting.

The appearance of the lighting installation is attractive as can be seen in the illustration. The continuous rows of light on 4½-foot centers assure uniform lighting over the entire area and merchandise can be displayed effectively at any point in the store.



**LIGHT CONDITIONED** from floor to ceiling. A canopy of RF units combined with a light reflecting white cement floor, floods this final assembly bay of a west coast plane plant with 36.4 foot-candles of horizontal and 20.5 foot-candles of vertical illumination.



**INTENSITY** at counter level of 50-foot-candles is maintained in this commercial installation. An increase in light to over 300 percent was obtained at little more than 30 percent increased input.

## RF LIGHTING SPEEDS PLANE ASSEMBLY

Long range B-24 bombers are speeded to completion in this light-bathed assembly bay at Consolidated's windowless plant, built by the Austin Company, Cleveland, Ohio. More than 20,000 rectified fluorescent units meet the lighting requirements.

In the assembly bay and receiving aisles, 2-lamp units, mounted 40 feet above the floor, are installed in twin rows on both sides of the bottom chord of the trusses spaced 25 feet apart. The fixtures, themselves, are on 8-ft., 4-in., centers and suspended from angle iron supports welded to the trusses.

Assembly bay lighting measurements, made after the lamps had burned an

average of 1500 hours, showed an average illumination intensity of 36.4 foot-candles. The illumination across the 200-ft. width of the bay is substantially uniform, building up near the mezzanines where additional units augment the bay lighting. The decrease in intensity along the outside wall does not affect production since this area is used as a traffic aisle.

The over-all vertical illumination, determined by averaging readings made in each of the four cardinal directions, averaged 20.5 foot-candles—better than half the average horizontal illumination.

The use of a light-reflecting cement floor in the assembly area accounts, in part, for the high level of vertical illumination. Having a reflection factor of 44 percent, this floor contributes much to reflecting light necessary for working on the underside of wing sections, fuselages and large sub-assemblies.

Standard light gray cement floors with a reflection factor of 27.4 percent is used elsewhere.

# 18 War Production Men report what happened *when seeing was improved*\*

## GREATER ACCURACY

**SHELL FUSE manufacturer:** Production increases of from 25 to 50 per cent as result of better inspection and more efficient machine operation.

**MOTOR TRUCK manufacturer:** Workmen read micrometers and scales more accurately.

**TEXTILE manufacturer:** Better seeing conditions a great aid in color matching.

## LESS SPOILAGE

**ROLLER BEARING manufacturer:** Grinder operators spot improper grinder performance more quickly and can correct it before work is spoiled.

**ELECTRICAL EQUIPMENT manufacturer:** Better seeing accompanied by five per cent reduction in errors.

**FACTORY OFFICE:** Reduction in office errors as result of changes in lighting.

## FASTER SEEING

**HEAVY MACHINE TOOL BUILDER:** Better seeing reduces time required to rebuild a machine.

**ELECTRICAL EQUIPMENT manufacturer:** Time required for machine set-ups reduced.

**AIRCRAFT PARTS manufacturer:** Less time lost by workmen hunting for tools.

## EASIER SEEING

**LAMP manufacturer:** Time for training new women operators greatly reduced.

**SMALL MACHINE PARTS:** Men can read scales and blueprints more easily at night than by daylight.

**FACTORY OFFICE staff:** Unable to keep up with increased work under poor seeing conditions, but now work is done without undue effort.

## INCREASED SAFETY

**ORDNANCE PLANT:** Increased safety, especially when breaking in new labor.

**SHIP BUILDER:** Lighting changes reduced blinding effect of flashes from welding torches.

**TEXTILE manufacturer:** Decreased fire-hazard.

## DECREASED FATIGUE

**MACHINE PARTS manufacturer:** Men on night shift gained weight.

**AIRPLANE PARTS manufacturer:** Morale improved; fewer yard fights.

**AIRPLANE PARTS manufacturer:** Fewer headaches; aspirin tablet consumption decreased from 1000 to 600 tablets per month.

### *Electrical Contractors and Maintenance Men*

The 18 comments summarized on this page typify the wide range of benefits resulting from improvements in seeing conditions.

They also indicate the important role that electrical contractors and maintenance men can play in war plants by helping them get the most from their present lighting equipment . . . through cleaning, relocation of fixtures, painting walls and machines, and removing glare from unshaded bulbs.

Remember, too, that Wartime Lighting Counselors are available to help you solve specific wartime lighting problems. Call your nearest G-E lamp office or your electric service company. General Electric Company, Nela Park, Cleveland, Ohio.

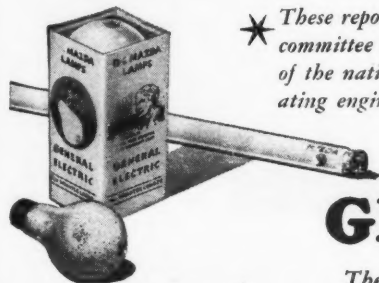
\* These reports are the result of a survey of war plants made under the direction of a special committee of the Illuminating Engineering Society, a non-profit professional organization of the nation's leading lighting authorities. Interviews were made by teachers of illuminating engineering of five leading technical colleges.

**G-E MAZDA LAMPS**

**GENERAL  ELECTRIC**

*The best Investment in the World is in this Country's Future — Buy War Bonds!*

Listen to the G-E MAZDA lamp "Hour of Charm" Sundays 10 P. M. EWT, NBC; and to "The World Today" weekdays 6:45 P. M. EWT, CBS.



# Questions ON THE Code

Answered by  
**F. N. M. SQUIRES**

Chief Inspector New York Board of Fire Underwriters

## Grounding for Welding Return

**Q.** "The use of electric welding has grown enormously in my territory. In one shipyard they connect the ground return to the steel hull of the ship at a point near the pier or dock on which the welding generators are located and they carry the cable for the welding electrode to any part of the ship where they want to do welding. Is this method correct?"—W.G.

**A.** The National Electrical Code does not cover the subject. However, the Code does not consider it proper to use the steel frame of a building as a conductor for electrical circuits. Also, the "Recommended Practice for Electrical Installations on Shipboard" of the A.I.E.E., recommends that all circuits on ships be complete metallic circuits and that no ground return circuits be employed.

Outside of the above requirements, or lack of requirements, we must, for highest efficiency, attach the return lead for welding as near to the parts to be welded, as is possible.

## Cable Clamps for Non-Metallic Sheathed Cable

**Q.** "On one of our jobs, where we are using non-metallic sheathed cable, the inspector raised the question as to the necessity of using box connectors where the cable enters the outlet boxes.

"It is our understanding that the Code does not require the use of any connectors where the cable is strapped not more than five inches from the outlet box.

"We would appreciate your opinion."  
—H.Z.A.

**A.** Section 3715 of the Code requires that where cable (armored or non-metallic sheathed) is used with metal outlet boxes, fittings or cabinets, the cable shall be secured to the outlet boxes, fittings or cabinets.

Section 3716 states that where non-metallic sheathed cable is used, with non-metallic outlet boxes, the cable shall enter the box through a knockout opening and that the clamping of individual conductors or of cables to boxes, is not required if the cable is supported within six inches of the box.

As to the question as to when non-metallic boxes are required or may be used, let us again call the facts to our readers' attention.

Non-metallic outlet boxes are required on non-metallic sheathed cable work

when the cable "having one circuit conductor without insulating covering" is used. This requirement is found in Interim Amendment No. 43.

Sections 3369 and 3716 permit the use of non-metallic outlet boxes only with open wiring on insulators, concealed knob and tube work, non-metallic sheathed cable and with non-metallic weather proof wiring and Interim Amendment No. 49 requires the use of non-metallic outlet boxes when the above mentioned wiring systems "are installed on premises where a continuous underground metallic water piping system is not available as a grounding electrode."

## Exposed Terminals

**Q.** "I am an old time wiring contractor and seem to have forgotten a lot about open wiring and its fittings. In some of the rooms of the house I am to wire, the ceilings are quite low, being only about 7 ft. above the floor. I have been to a lot of supply houses in New York City to get cleat-type lamp receptacles for open wiring and can only obtain those having exposed terminals. The supply houses tell me that those are the only ones being used and are the only ones they have. Is it a violation to use them, under the conditions stated above?"—A.D.

**A.** Evidently the manufacturers and supply dealers are only distributing the devices for which there are the heaviest demands and evidently the demand is only for receptacles which are out of reach. In the old days while



**TWIN-CITY SPECIALISTS** review latest priorities and price regulations affecting the electrical industry at the recent N.C.E.I. War Conference in Minneapolis. They are (L to R): Al Kessler, N.C.E.I., chairman; H. L. Warner, Minneapolis W.P.B.; C. L. Davis, Twin-Cities District price specialist; W. L. Sprague and S. J. Tabor, Minneapolis W.P.B.; and L. G. Mample, N.C.E.I.



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SATURDAY EVENING POST

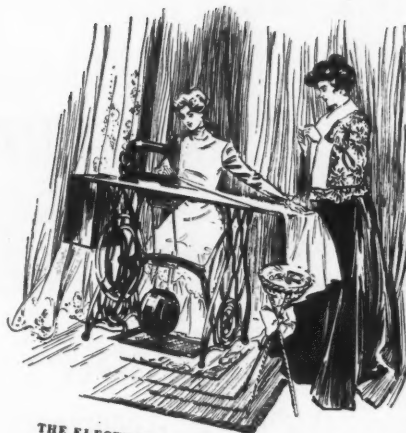
Better Homes  
& Gardens  
AMERICAN HOME

## This Sewing Machine Motor Started Something!

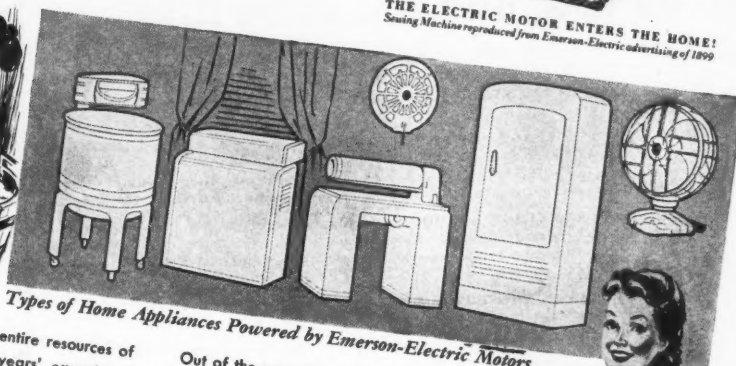
An historic event—at the turn of the century—was the development of an Emerson-Electric Motor for attachment to the foot-power sewing machine, then in use.

This simple motor application marked the beginning of an era in which an entire industry was founded, bringing a multitude of labor-saving, motor-driven appliances and comfort conveniences for the home.

Throughout this long period, Emerson-Electric Motors have played a major role in powering these appliances. They have lifted the yoke of household drudgery and created the opportunity for American Womanhood to achieve a fuller life.



THE ELECTRIC MOTOR ENTERS THE HOME!  
Sewing Machine reproduced from Emerson-Electric advertising of 1899



Types of Home Appliances Powered by Emerson-Electric Motors

When war came, the entire resources of Emerson-Electric's 53 years' experience were quickly converted and tremendously expanded for manufacturing vital implements of war—power-operated revolving gun turrets, shell parts, and many new types of electric motors for aircraft.

Out of the urgencies of war will come entirely new conceptions of electric motor design, construction and efficiency. "After Victory", manufacturers of the new and improved motor-driven appliances and equipment will confidently power their products with these motors.

THE EMERSON ELECTRIC MANUFACTURING COMPANY  
SAINT LOUIS • Branches: • New York • Detroit • Chicago • Los Angeles • Davenport



"Until the war, I never fully appreciated the importance of the electric motors on my home appliances."

In recognition of their patriotism and great work, Emerson-Electric workers were presented with the Army-Navy "E" Award.

# EMERSON ELECTRIC

MOTORS • FANS • APPLIANCES • A. C. ARC WELDERS

This advertisement is addressed to the women of America. It traces the development of electric motor-driven appliances for the home and the new and better creations which are certain to stem from the experience gained in producing for war.

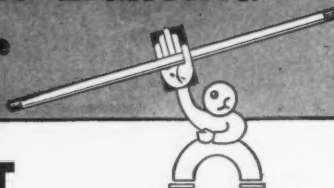
Thousands of Emerson-Electric Retailers and Service Stations are rendering a loyal

service by keeping motor-driven appliances on full-time duty on the home front. To them is extended the sincere appreciation of the nation.

THE EMERSON ELECTRIC MANUFACTURING CO.  
ST. LOUIS • Branches: New York • Detroit • Chicago  
Los Angeles • Davenport

# At last! REALLY DEPENDABLE, TROUBLE-FREE FLUORESCENT LIGHTING

made possible by the exclusive  
developments of Artkraft



## ARTKRAFT

"LONG LIFE"\*

### HOT CATHODE FLUORESCENT LIGHTING SYSTEMS

1. **NO STARTER SWITCHES**—Artkraft resonant starting eliminates this trouble-maker which has always required constant servicing and replacement.
2. **THE ONLY GUARANTEED LAMP**—Guaranteed for 3,000 hours. Rated life 5,000 to 6,000 hours.
3. **CONSTANT VOLTAGE POWER PACK**—Efficient operation at 85 to 135 volts. Good lighting assured where overloaded lines and wide fluctuations of voltage make impossible the use of all other fluorescent systems. Also adaptable to 220 and 440-volt systems, single or three-phase. Cannot short-circuit the line.
4. **CONSTANT-TEMP HOT CATHODE**—Corrugated mesh ribbon filament permits the use of abundantly more emissive compound, and control of secondary voltage and Constant-Temp feature furthermore prevent rapid discharge of this compound.
5. **BLACKENING IN LIGHT COLUMN REDUCED** by exclusive cathode design, assuring a brighter lamp.
6. **100% POWER FACTOR** at rated voltage, 98% or over within 85 to 135-volt range.
7. **"EASY MOUNT" LUMINAIRE** permits instant removal, without tools, for cleaning non-ferrous reflector or lamps.
8. **STROBOSCOPIC (FLICKERING) EFFECT SUBSTANTIALLY REDUCED.**
9. **BALLAST REPLACEMENTS UNKNOWN.**
10. **MORE LIGHT FOR THE SAME CURRENT.**
11. **FIELD TESTED FOR OVER FIVE YEARS.**
12. **MODERATE FIRST COST.**
13. **EXCLUSIVE FEATURES RADICALLY REDUCE MAINTENANCE COSTS** and save many man-hours.



Write for Folder F-102

**WHOLESALEERS:** Write for proposition.

**FIXTURE MANUFACTURERS:**

Investigate our licensing proposition at once. Artkraft Systems are now available through the manufacturing and distributing facilities of  
EDWIN F. GUTH CO.  
F. W. WAKEFIELD BRASS CO.  
FOSTORIA PRESSED STEEL CORP.



## ARTKRAFT

HOT CATHODE  
FLUORESCENT LIGHTING

Division of  
THE ARTKRAFT SIGN COMPANY

1113 E. Kibby St.

Lima, Ohio, U. S. A.



\*Reg. U. S. Pat. Off.

*Questions  
in the Code*

[FROM PAGE 86]

most of the lamp receptacles were installed on the ceilings and thus were out of reach, some were, however, installed on sidewalls and were thus within reach of persons and therefore could not be of the type having exposed terminals.

The Code rule on this is found in Section 4104, which states that in general there should be no live parts of wiring devices and appliances exposed to open contact, "except in the case of cleat-type lamp holders, receptacles and rosettes which are located at least eight feet above the floor."

Therefore in case of a 6-ft. ceiling all live parts, such as terminal connections, must be covered in order to prevent accidental contact.

### "SN" for Wet Locations?

**Q.** A telegram from the Southwest reads: "Desire substitution of Type SN wire in place of more critical and harder to obtain types VLC and RW wires. Substitution type apparently will give good service but some claim Code violation. Please advise if violation exists?"—W.F.

**A.** As the inquirer mentions Types VCL and RW, it must be assumed that he desires to use the wires in a wet location or as described in Section 3035.

Our advice to him was that at present the use of synthetic Type SN wires in a wet location is a violation of the National Electrical Code.

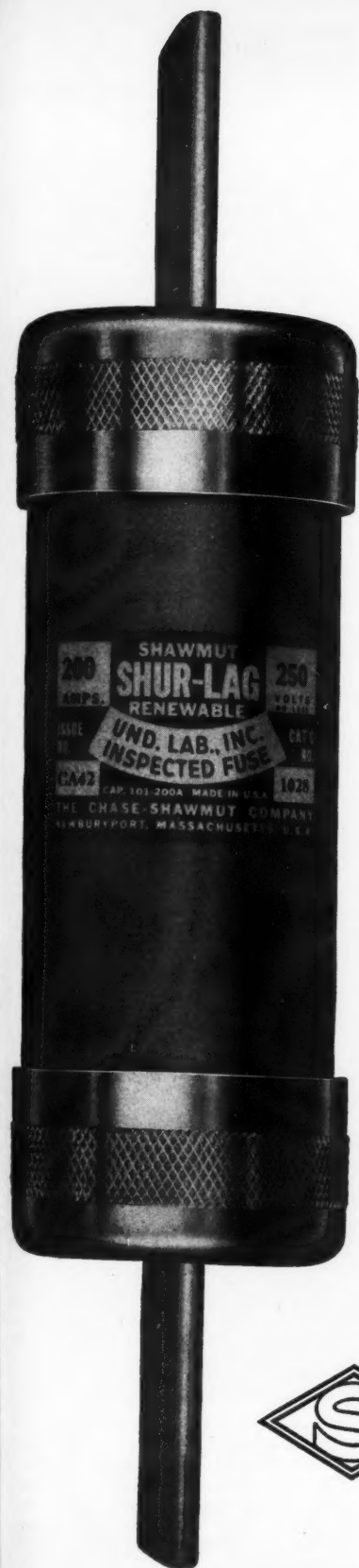
We did further advise him however, that the Underwriters' Laboratories is now testing a synthetic insulation for one wire manufacturer for use in wet locations. If this test is successful so that the Laboratories feel that the use of this wire will be safe in wet locations, undoubtedly there will be an interim amendment to the Code covering this. This wire will probably be known as Type SNW.

### Three-Pole Attachment Plugs

**Q.** "A question has arisen as to the proper connections to a 3-wire attachment cap.

"A 3-wire receptacle has no white contact screw; instead it has two brass colored and one dark screw. One of the brass screws is marked "Gr", meaning "ground"; this leaves one brass and one dark screw which may be used as circuit

Electrical Contracting, July 1943



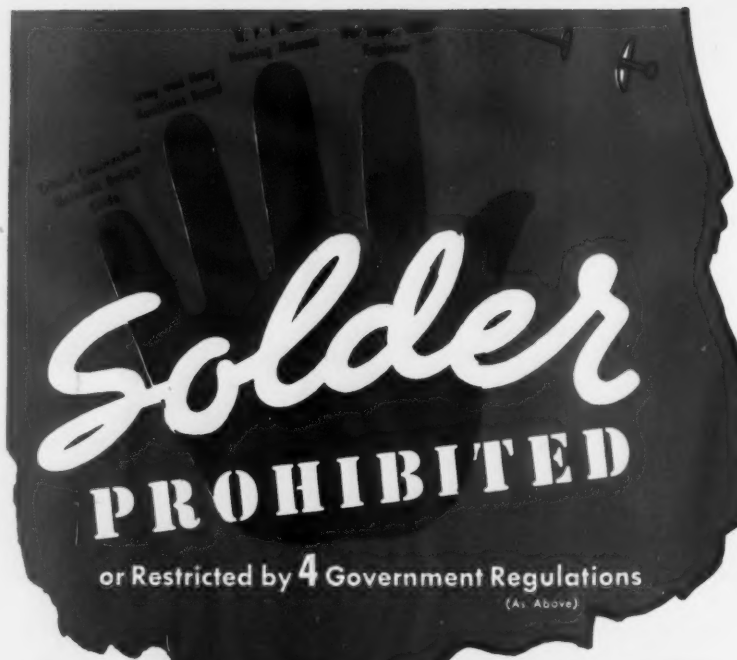
FIFTY YEARS  
OF QUALITY IN THE  
MANUFACTURE OF  
ELECTRICAL EQUIPMENT  
FOR CIRCUIT PROTECTION

★ 1893-1943 ★

SHAWMUT IS  
THE WORD  
FOR FUSES



THE CHASE-SHAWMUT COMPANY  
NEWBURYPORT, MASSACHUSETTS



... And here's the IDEAL Solution to the Problem!

**IDEAL**



**Meet ALL Government Requirements**

An ALTERNATE and IMPROVEMENT for Solder and Tape Wire Joints. IDEAL "Wire-Nuts" (Solderless, Tapeless, Wire Connectors) contain no copper or copper alloys—no Tin or Rubber as used with solder-and-tape joints. Because "Wire-Nuts" do not require these critical materials, they are *immediately available*. They help Speed Your Job—and Help Speed Victory; every time you use "Wire-Nuts" you *conserve vital materials* needed for the war program. Easy to use; strip wires, screw on, that's all!



### Better Electrically, Stronger Mechanically

"Wire-Nuts" powerful grip on wires prevent shorts, grounds and corrosion,—and they withstand several times greater pull than the best soldered joint.

Fully Approved. Listed by Underwriters' Laboratories, Inc. Sizes for connecting all combinations from two No. 18 to three No. 10 solid or stranded wires.

If your Electrical Jobber hasn't a supply, kindly write or wire, mentioning Jobber's name.

**Prompt Delivery**



**IDEAL Sycamore**  
★ IDEAL COMMUTATOR DRESSER CO ★

1041 Park Ave., Sycamore, Ill.

Sales Offices in all Principal Cities

*Questions  
OF THE CODE*

[FROM PAGE 88]

posts for a 2-wire job. On a 3-wire connection it has been assumed that the neutral would take the ground post.

"The attachment cap for this receptacle has one long and two short prongs. The longer one is plainly marked 'ground' and will coincide with the slot of the ground terminal in the receptacle.

"Will you please state the proper way this receptacle and cap should be used?"  
—H.W.S.

**A.** Section 2009 requires that the markings identifying terminals shall be done by means of a metallic plated coating substantially white in color, as nickel or zinc, or the terminals may be of material substantially white in color.

In all probability the terminal which our correspondent mentions as being "one dark screw," was originally plated with some metal "substantially white in color," but which color has turned dark through discoloration by corrosion; but this "dark screw" is the identified one which should be used for the connection to the neutral wire of the circuit.

Underwriters' Laboratories require that some other color than brass be used for the identified terminal.

The Laboratories have standardized the position of the 3-wire plugs so that a 3-wire plug may be used either on a 2-wire circuit with provision for grounding, or, on a 3-wire single or three phase circuit. Where one pole is used for grounding, the long prong which is

Long terminal for ground—

Neutral other than brass—  
Nickel-cadmium-zinc  
(may corrode)



If for 3 phase, no attention need be paid to markings

placed radially from the center of the plug is to be used for the grounding connection; this one is generally marked with a "G". Where a 3-wire circuit, either single or three phase, is to be connected, the long "G" prong is used for one of the live legs and the neutral of the single phase circuit is to be connected to the "white colored" screw.

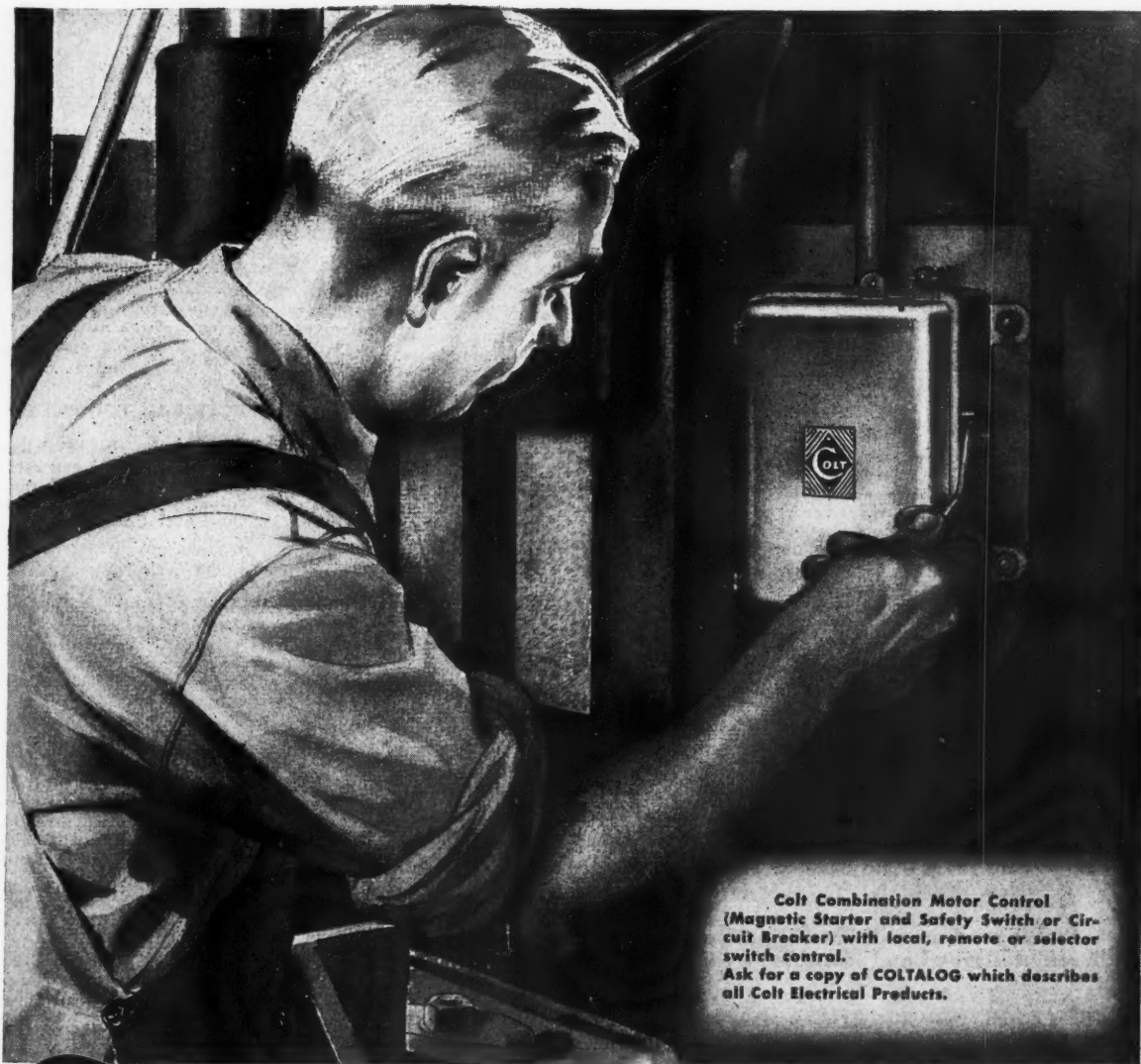
### Pa. License Bill in Committee

Introduced into the Pennsylvania legislature on March 8, 1943, House Bill No. 618, was referred to the committee on Public Utilities. The Bill provides for the establishment of a state electrical code, inspection, a board of examiners and the licensing of electrical contractors and journeymen.

Electrical Contracting, July 1943

# Colt Precision

The smooth, dependable functioning of Colt Revolvers and Automatic Pistols is an accepted feature equally assured in precision-built Colt Electrical Products.



Colt Combination Motor Control  
(Magnetic Starter and Safety Switch or Circuit Breaker) with local, remote or selector switch control.  
Ask for a copy of COLTALOG which describes all Colt Electrical Products.

## **COLT** *Engineered* **MOTOR CONTROLS**

COLT'S PATENT FIRE ARMS MFG. CO., ELECTRICAL DIVISION, HARTFORD, CONN.

*Electrical Contracting, July 1943*

# Keep Up-to-Date on new developments

through this **FREE SERVICE** . . . . .

Electrical Contracting brings you the latest literature of leading manufacturers without cost or obligation.

**1** A 36-page catalog illustrating and describing Nofuze; Quicklag; Uni-Breaker; Switch-and-Fuse; Safu-switch panelboards. It features tables on motor ratings; current carrying capacities; switch, circuit breaker and wire size for motor circuits. Kinney Electrical Mfg. Company

## WIRING DEVICES

**2** A new Victory catalog featuring this complete line of fastening and hanging devices. A visible index makes every product page available quickly. The Paine Co.

## ELECTRIC TOOLS

**3** A 20-page, pocket size manual, giving complete instructions on the proper operation and care of all types of portable electric tools. It covers maintenance of the motor, cable, switch and brushes. Independent Pneumatic Tool Company

## FREQUENCY METERS

**4** Bulletin VF-43 consists of 8 pages of data on vibrating reed frequency meters. Illustrations and dia-

grams are shown. J-B-T Instruments, Inc.

## RECTIFIERS

**5** Bulletin GEA-4047 illustrates portable sealed-ignitron mercury-arc rectifiers for mining service. It describes the unit and operation, lists advantages and shows how the ignition works. General Electric Co.

## RELAYS

**6** Bulletin 800 illustrating and describing Type TDC time delay relays. Wiring diagrams and circuit table are also shown. The R. W. Cramer Company, Inc.

## TRANSFORMERS

**7** A new bulletin entitled "Power Where You Need It" outlines and gives examples of air cooled transformer applications in war production industry. Acme Electric & Mfg. Co.

## CONNECTORS

**8** A 32-page catalog illustrating and describing this line of electrical connectors and fabricated tube parts. Ilasco Copper Tube & Products

## CABLE TERMINATORS

**9** A new publication No. 4303 giving data on "PB" indoor cable terminators for voltages up to and including 2300. Construction dimension details are given. Delta-Star Electric Company

## FLUORESCENT FIXTURES

**10** Catalog No. 400 illustrates and explains the new Mitchelite line of fluorescent fixtures for war industry. It gives details and prices on the four new models. Mitchell Manufacturing Company.

## MARINE ELECTRICAL EQUIPMENT

**11** Bulletin 3100 describes and lists Marine switchboards, generator boards, power and light distribution panelboard and drip-proof switches for marine use. Square D Company

## BRAZING ALLOY

**12** Booklet B-3201 discusses how to braze with Phos-Copper, which can be used with gas, incandescent carbon, electric furnace and dip brazing methods. Westinghouse Electric and Manufacturing Co.

## FLUORESCENT LIGHTING

**13** Catalog No. 43-V illustrates and describes Silv-A-Tex, the new non-critical reflector material used for Silv-A-King Victory fluorescent lighting units for industry. Bright Light Reflector Company

## CAPACITATORS

**14** Catalog No. V-1 features "Preferred-Type" capacitors for civilian radio maintenance and Catalog No. V-2 illustrates them for government and industrial electronic applications. Solar Capacitor Sales Corp.

## MARINE ELECTRICAL EQUIPMENT

**15** Catalog No. 9-S-2 illustrates and describes marine electrical equipment. Some of the items covered are boxes, indicators, lighting fixtures, supply and control panels and terminal tubes. The M. B. Austin Company

[Continued on page 94]

Circle numbers, sign and paste on your letterhead and mail in an envelope.

## ELECTRICAL CONTRACTING

300 West 42nd St.

New York, N. Y.

July

(Not good after September 1)

Please send me without obligation, manufacturers' literature herein described and identified by numbers circled below.

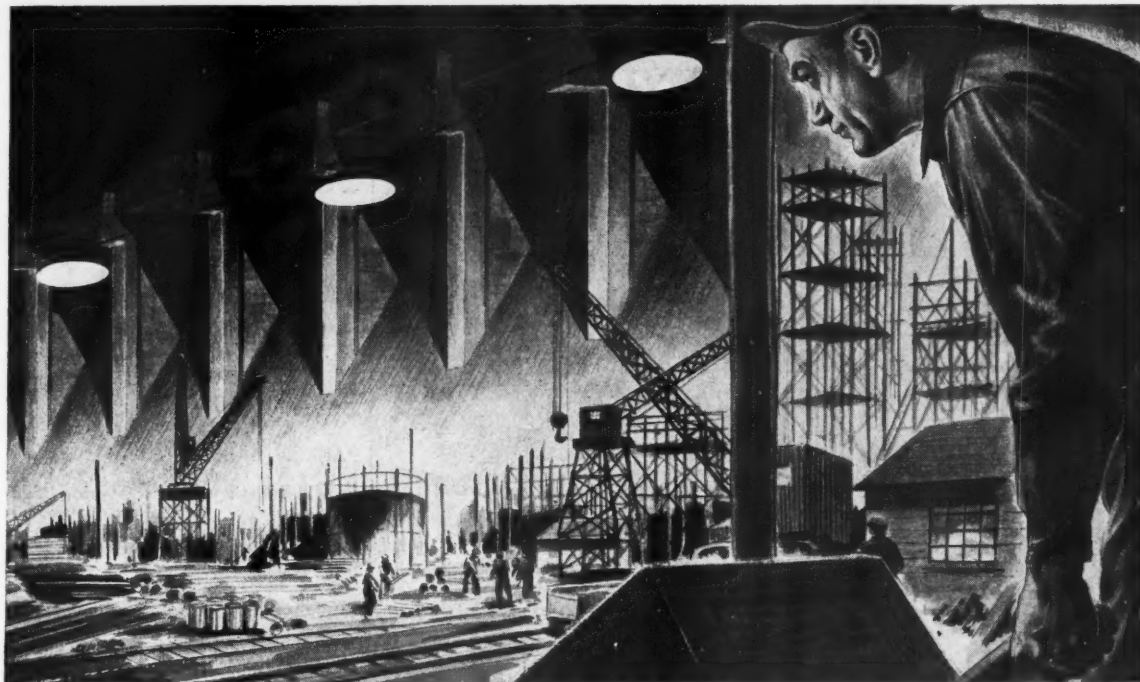
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15  
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30  
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45  
46

NAME . . . . . TITLE . . . . .

COMPANY . . . . .

ADDRESS . . . . .

CITY . . . . . STATE . . . . .



## Hand-made light fixtures saved 60 days

*Wesco-built In 6 Hours They Enabled  
War Dam Night Shift to Start On Time*

Construction of the Pacific Coast hydro-electric dam was losing the race against war plant power needs. A night shift was established but special weatherproof lighting fixtures were unobtainable for 60 to 90 days. The General Superintendent phoned Wesco in the emergency—"At 5 tonight 12 reflectors to meet our needs must be ready."

The Wesco manager knew that dim-out regulations forbade the use of floodlights. The solution was to suspend weatherproof reflectors from cables stretched across the ravine. But suspension fittings could not be had. Combing his stock, the Wesco Manager put together a 1000 Watt reflector, a close pipe nipple and a type "C" conduit and thus improvised a thoroughly waterproof lighting unit. The 12 fixtures were made in 6 hours and were ready on time.

Wesco ingenuity and know-how will be at the service of business and industry following the unconditional surrender of the Axis.

### WESCO SPEEDS WAR PRODUCTION

- \* War plant burned down on a Friday was operating on the following Monday—thanks to Wesco's prompt delivery of motors, switches, wire, and other items from local stocks.
- \* Within three days Wesco completed delivery of 68 different items to an important war plant. Best delivery of other sources was 12 weeks.

### WESCO SERVES BUSINESS

- \* By buying large quantities at low prices and passing the savings on to small-quantity buyers.
- \* By furnishing informative and technical data.
- \* By knowing local and national codes and rulings.

# Westinghouse Electric Supply Co.

150 VARICK STREET • NEW YORK (13), N. Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

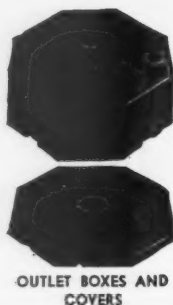
# Save with ILLINOIS All Porcelain WIRING SYSTEMS....

- ★ USE LESS VITAL MATERIALS
- ★ DO JOBS IN LESS TIME
- ★ CUT MAINTENANCE

For the customer, porcelain protected wiring systems mean permanency of installation, economy, safety, dependable service where dampness and fire hazards are prevalent.

Illinois all porcelain wiring systems are adaptable to practically all wiring plans and layouts—they are easy to install and can be installed without grounding.

Porcelain is not a critical material—use it for your next installations.



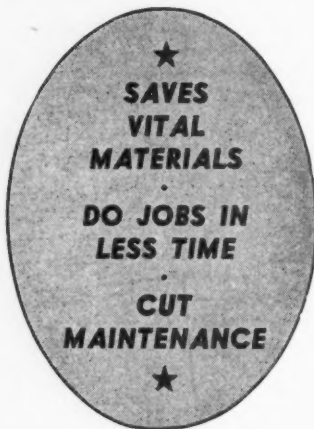
OUTLET BOXES AND COVERS



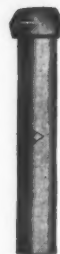
SWITCH BOXES AND COVERS



TOGGLE SWITCH PLATE



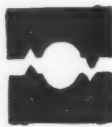
Look for this  
Trade Mark



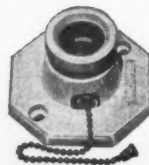
STANDARD TUBES



STANDARD KNOBS



CLEATS



LAMP HOLDERS

**ILLINOIS ELECTRIC PORCELAIN CO.**  
MACOMB, ILLINOIS

## New Literature

[FROM PAGE 92]

### LUGS AND CONNECTORS

**16** A folder illustrating and describing solderless terminal lugs and connectors. Catalog numbers and range of wire sizes are given. Krueger & Hudepohl

### WIRE STRIPPER

**17** A bulletin featuring the Speedex wire stripper for all types of wires and a new electric trouble-shooter and inspection light. Wood Specialty Manufacturing Co.

### PANELBOARDS

**18** Bulletin 2500 covering Saflex power distribution panelboards has been revised. Special panels are built to government requirements. Square D Company

### WELDER

**19** A bulletin illustrating and describing the new Ampac "200" alternating current welder. Allis-Chalmers Mfg. Co.

### INSULATION

**20** Bulletin No. 143 is entitled "Thermobonds, the New Insulation." They are for application to such units as high speed armatures, high cycle drill and grinder motors, heavy duty motors and transformers, and marine engine magneto coils. The Sterling Varnish Company

### ELECTRONIC DRIVE

**21** Booklet B3256 describes Mot-O-Trol, an electronic adjustable-speed drive which provides wide stepless range, automatic speed regulation and smooth fast acceleration with automatic current limitation. It tells how the Mot-O-Trol works and lists its advantages. Westinghouse Electric & Mfg. Co.

### LIGHTING

**22** A new 12 page booklet entitled "Save with Balanced Lighting." It tells what it is, how to achieve it and its results. The Foastoria Pressed Steel Corporation

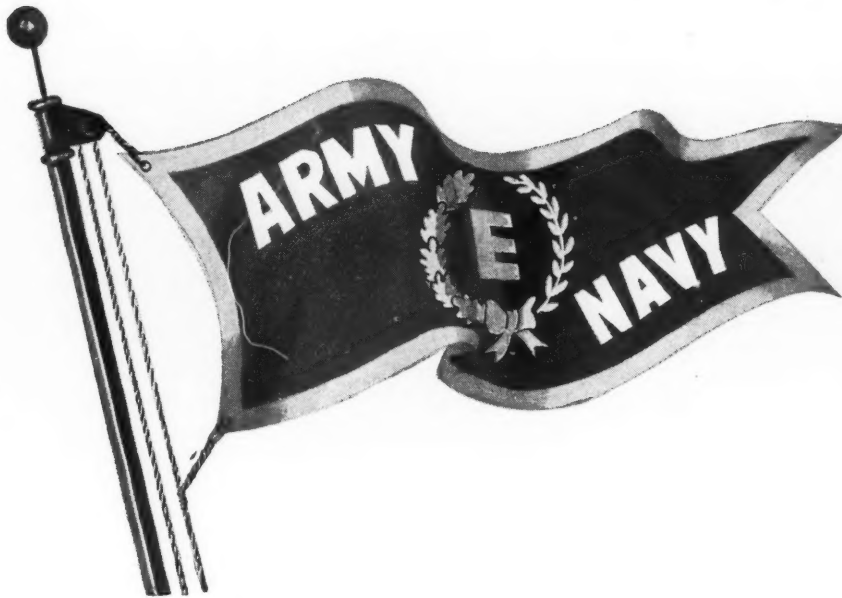
### FITTINGS

**23** Catalog No. 243 consists of 20 pages of data and illustrations of this line of outlet boxes, under floor raceway box, receptacles, conduit former, and "Ovalets." Lew Fittings Company

### ELECTRICAL EQUIPMENT

**24** Bulletin GEA-3147 describes the complete line of electric equipment for aviation-gasoline plants. It [Continued on page 96]

*In World War I, Wakefield made riding lights, bulkhead lights and "blinker guns" for the Navy. Today we're in war service again.*



## First in Peace . . . First in War . . . Wakefield

**WE'RE** mighty proud to be the first in our field to fly the Army and Navy "E". This tops a series of Wakefield "firsts" which have brought the benefits of improved lighting to millions through our 37 years of peace and war service.

*We're especially proud of this honor:*

**Because** we know that our equipment has helped save fighting ships and the lives of your sons at sea; because we're helping others to do their best in the battle of production.

**Because** to us it stands for the untiring efforts of all our workers . . . for their readiness

to work long hours at any time, if necessary to get the job out . . . for their willingness to switch to new duties, even at a temporary personal loss . . . for their loyalty which has put aside grievances, never letting them delay war production.

**Because** it stands for ingenuity in making available equipment perform new work to speed delivery . . . in developing new equipment to fit wartime needs and conditions.

**Because**, more than ever, it makes us conscious of our part in the war effort, and eager to do all that we can on Today's Biggest Job.

## THE F. W. WAKEFIELD BRASS CO.

VERMILION, OHIO

★ Fluorescent and Incandescent Lighting Equipment for War Production, Damage Control Lights, Binocular Blinker Lights, Mine Buoy Lights, Army Marker Lights, Floating Lanterns, Cabin Lights for Liberty Ships and troop transports, Airplane Motor Parts, Navy Blackout Shields, Blackout Trouble Lights, Lighting Specialties for Military Use. ★

## THE NEW MODEL 590

# VOLTAGE TESTER

READS LIKE A THERMOMETER!!



### Automatically Indicates

- Whether the voltage is 110, 220, 440 or 660 Volts.
- If the current is A.C. or D.C.
- If the appliance, motor, etc., connected in the line is "open."
- Which leg is "grounded."
- If the frequency is 25 or 60 cycles.
- If the fuse is "blown."
- When one side of an appliance or motor connected to the line under test is "grounded."
- Excessive leakage between a motor and a line.
- When a three phase motor is running erratically due to a "blown" fuse.

NO METER, NO SWITCHING, NO TIP JACKS. To use: simply connect the needle pointed test prods across any line and this truly versatile instrument will instantly indicate the Voltage, Frequency, type of Current, etc. Rugged, dependable and efficient, this amazing electric tester measures only  $1\frac{1}{4} \times 5 \times 1\frac{1}{2}$ " and weighs only 5 ounces. Four individual GE type NE-7 neon bulbs used in conjunction with a network of resistors provide most of the services necessary for all industrial electrical maintenance. Unlike most electrical testing instruments which necessarily require a great amount of care, the Model 590 is designed for "bang around" maintenance work, and yet due to the unique design it compares favorably in sensitivity with expensive metered instruments in that it draws less than 1 Milliampere of current.

Model 590 comes housed in a beautiful hand-rubbed wooden cabinet. Panel is of etched steel. Shipping weight 2 pounds. Complete with instructions.

ONLY  
**\$5.85**

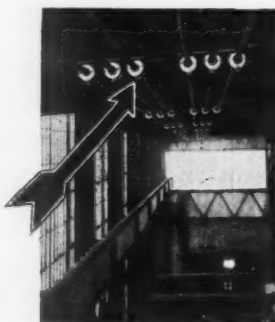
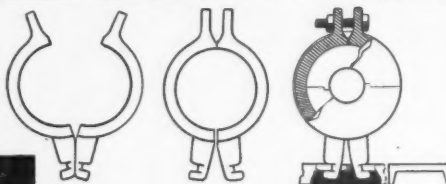
## SUPERIOR INSTRUMENTS CO.

Dept. E. C.

227 Fulton Street, NEW YORK, N. Y.

## "EFFICIENCY" DEVICES FOR CONDUIT AND CABLE SUSPENSION

### THE EFFICIENCY CABLE RACK



Cable Racks available for Cable diameters from 5/16 to 2"

... a definite step forward in cable suspension! Note, in the illustration, the simplicity and convenience of this new type support. Tightening a single bolt spreads the flanged foot portions to engage the sides of the hole in the rack. This same operation clamps the bushing securely and permanently in place ... makes a positive fastening which cannot be loosened by vibration or shock. Each fitting is a separate unit ... permits the installation of each line or cable independently. Each customer's rack is made up with mountings to carry your designated number of cables. For A. C. service a brass half is used.

This design offers minimum resistance. Make this new bushing support and rack your choice for simplicity of installation and ease in stringing cable.

Complete information on all EFFICIENCY Electrical Devices is available. Write today for your copy of Catalog No. 38A.

*Efficiency*  
ELECTRIC AND MANUFACTURING CO.



MANUFACTURERS OF EFFICIENCY  
ELECTRICAL DEVICES FOR CONDUIT,  
WIRE AND CABLE SUSPENSION

1000 EAST VALENTINE, CHICAGO

## New Literature

[FROM PAGE 94]

covers power generation, power distribution and power utilization. General Electric Co.

### LIGHTING UNITS

**25** Catalog No. 102 features the Swivelier Work-Lite units which are adjustable, unaffected by machine vibration and stay put at any angle. Reliance Devices Company, Inc.

### RHEOSTATS AND RESISTORS

**26** Bulletin No. 550 describes this new line of slide contact rheostats and fixed tubular resistors with adjustable band. Herman H. Sticht Co., Inc.

### LIGHTING UNITS

**27** Bulletin F-63 illustrates and describes four new models of portable lighting units for fluorescent lamps, for use in various war production plants for assembly, maintenance and servicing operations. DayBrite Lighting, Inc.

### WIRING SYSTEMS

**28** Catalog No. 143, consisting of 20 pages, illustrates and describes plastic duct wiring systems for the extension of power and light for war industry. Pierce Laboratory, Inc.

### BATTERY-CHARGING EQUIPMENT

**29** Bulletin GEA-3923 describes automatic battery-charging equipment for motive power batteries. It includes single battery control, multiple circuit battery control and motor-generator sets. General Electric Co.

### HANDBOOK FOR WELDING

**30** A 20-page, pocket-size booklet, entitled "Handbook for the Welding and Cutting Operator. It instructs users of the oxyacetylene welding and cutting process how to prolong the life of their equipment. International Acetylene Association

### MOTOR CONTROL

**31** A new book "Unitrol—the next step forward in Motor Control" gives full description of Unitrol, its uses and advantages, its construction and specifications. It is profusely illustrated. Cutler-Hammer, Inc.

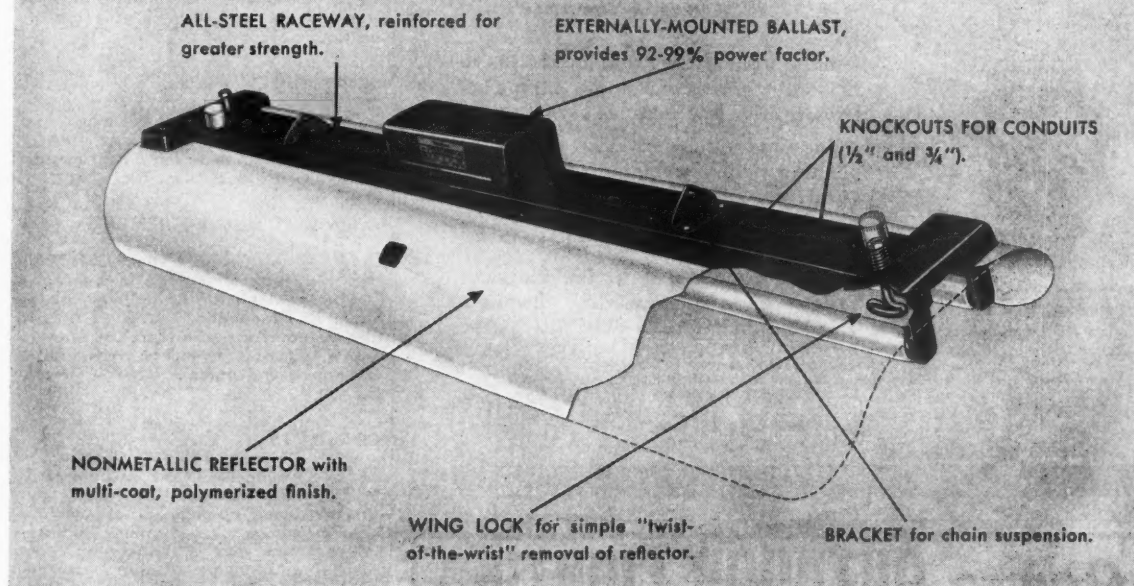
### EXTRACTORS

**32** A new catalog illustrating and describing heavy duty extractors to remove stub ends of pipe, nipples, tubes, bolts or screws. Reps Tool Co., Inc.

### RADIO AND ELECTRONICS

**33** A new Buying Guide covering everything in radio and electronics. Included are complete detailed [Continued on page 98]

# DESIGN FOR BETTER LIGHTING



## Top Performance and Advanced Features Offered in New LIGHTWEIGHT Luminaire

A worthy successor to Prewar Westinghouse Luminaires is this new fluorescent fixture conforming with General Limitation Order L-78. While lighter in weight and built with a minimum of critical materials, it provides highly efficient, glareless illumination combined with long life and ease of maintenance.

The moisture-resistant, nonmetallic reflector is covered with a multi-coat, polymerized finish which provides a reflection factor of 85% or more. And it requires only a "twist-of-the-wrist" to attach or remove this reflector, making it easy to keep clean and at peak efficiency.

The steel raceway is further reinforced at critical stress points. The ballast, now externally mounted, provides a power factor ranging from 92 to 99%.

This new Westinghouse Luminaire is available for use with two or three 40-watt and two 100-watt Mazda F Lamps, in individual units or continuous strip installations. Any one of 117 Westinghouse Electric Supply Company Offices and Independent Lighting Distributors will give you full details regarding these luminaires and their installation. Or write Westinghouse Electric & Mfg. Co., Edgewater Park, Cleveland, Ohio, for booklet B-3265.

# Westinghouse



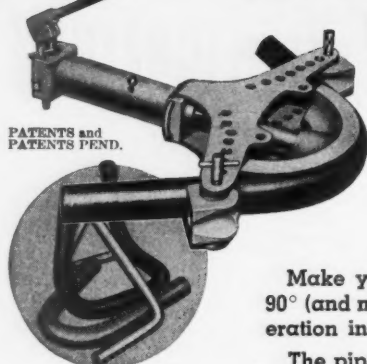
## *Lighting Equipment*

Plants in 25 cities . . . Offices everywhere

Electrical Contracting, July 1943

97

## TAL'S Prestal HYDRAULIC PORTABLE



PATENTS and  
PATENTS PEND.

### PIPE BENDER

for steel pipe and conduit  
from 3/8" to 4 1/2"

- NO HEATING
- NO FILLING
- NO KINKS
- NO WRINKLES

Make your offsets and bends up to 90° (and more) in one single, simple operation in a few minutes.

The pipe is **NOT MOVED** during the bending thus avoiding kinks and wrinkles. All bends—one or 1000 all identical and perfectly uniform even if made by "green hands."

Quick changeover to various sizes. Few seconds to mount and dismount. **FASTEST PORTABLE BENDER!**

#### SMOOTHNESS OF BENDS:

No wrinkles—no kinks—no breaking of pipe due to scientific development of bending formers. No job too complicated.

Obtainable in three different sizes  
Meets U. S. Navy, Army & Maritime Comm. Specifications  
Write today for circular giving complete description

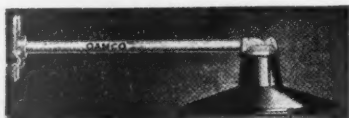
**TAL'S PRESTAL BENDER, INC.**

Dept. E7

Milwaukee, Wisconsin



## Oamco OUTDOOR LIGHTING FIXTURES of all types—for all uses



Bracket type  
fixture



Enclosed  
Floodlight

The complete line of Overbagh & Ayres OAMCO Outdoor Fixtures, ranging from enclosed floodlights to bracket fixtures is now available for all types of essential installations—from farms to war plants.

An Enclosed Outdoor Floodlight and a Bracket Fixture are illustrated at left. Designed and constructed to withstand hard usage outdoors, these reflectors are porcelain enameled and all brackets and fittings are electro galvanized. Write today for our new catalog No. 104.

**RIGHT LIGHT SINCE 1902**

**OVERBAGH & AYRES MFG. CO.**

MEMBER OF THE R L M STANDARDS INSTITUTE

411 SOUTH CLINTON STREET • CHICAGO

## New Literature

[FROM PAGE 96]

listings of transformers, resistors, condensers, rheostats, relays, switches, rectifiers, electronic tubes, tools, wire and cable. Allied Radio Corp.

### PANELBOARD AND CABINETS

**34** Bulletin No. 69 consists of 24 pages of information on panelboards and cabinets. It includes illustrations and diagrams. Frank Adam Electric Co.

### INSTRUMENTS

**35** Bulletin No. 127 describes new additions to the R.C.P. line of electrical and electronic instruments. Radio City Products Co., Inc.

### FARM ELECTRIC EQUIPMENT

**36** A four page leaflet, GES-3086, entitled "How to Keep Farm Electric Equipment 'On Its Toes' for the Battle of Production." It gives tips on the maintenance and care of motors, wiring, lighting, brooders, refrigeration equipment and pumps. General Electric Co.

### CONTACTS

**37** Catalog No. 52, consisting of 36 pages, discusses the design, manufacture and application of electrical contacts of silver, platinum, tungsten, molybdenum and a variety of other metals and alloys. Callite Tungsten Corporation.

### REGULATORS

**38** Booklet B-6056 reviews the redesigned feeder voltage regulators of the "unit construction" type. It is illustrated with installation photographs, operational drawings and standard rating charts, also contains a section describing the theory of step-type regulator operation. Allis-Chalmers Manufacturing Company

### HYDRAULIC EQUIPMENT

**39** Catalog No. V-43 is a wartime buyer's reference on hydraulic hand jacks; wheeled service jacks, gauge-equipped jacks; "Porto-Power" hydraulic units, maintenance kits, and pipe benders. Blackhawk Mfg. Co.

### IGNITRON CONTACTORS

**40** Bulletin GEA-3058B illustrates and describes ignitron contactors for power switching of a.c. resistance welding machines. It outlines the features and shows their construction. General Electric Co.

### BUSHINGS AND BEARINGS

**41** An 84-page catalog, No. 35, lists sizes and prices of finished bronze bushings and porous oil-retaining bearings. Oil-retaining bronze bearing. [Continued on page 100]

Electrical Contracting, July 1943

# FROM SHORE BASES to SHIP BROADSIDES...

*AmerTran  
Serves the  
NAVY!*

## AT SHORE BASES

POWER TRANSFORMERS

HIGH VOLTAGE  
TEST EQUIPMENT

## ABOARD SHIP

SEARCHLIGHT CONTROL

ANTI-AIRCRAFT  
RANGE FINDERS

FIRE CONTROL

UNDERWATER SHIP LOGS



OFFICIAL U. S. NAVY PHOTO

THE wide range of AmerTran applications is strikingly revealed in the many jobs they are doing for our Navy. At the bases are the AmerTran power transformers and high voltage test equipment. Aboard ship are AmerTrans in the searchlight control and anti-aircraft range finders. In fire-control, too, AmerTrans help keep the battlewagons' guns on the target. Even under water, there are AmerTrans—in ship logs.

To meet these war needs, important advances are being incorporated in AmerTran products. They are being proved daily under severe service and climatic conditions. Your post-war AmerTran equipment will reflect these improvements in the form of greater ruggedness, economy, ease of installation and higher efficiencies.



AMERICAN  
TRANSFORMER COMPANY  
178 EMMET STREET, NEWARK, N. J.



PIONEER MANUFACTURER OF  
TRANSFORMERS, REACTORS AND RECTIFIERS  
FOR ELECTRONICS AND POWER TRANSMISSION

*Electrical Contracting, July 1943*

# AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK, N. J.



## Your Production IS DIRECTLY RELATED TO Your Lighting!

Workers work **quicker** when they see **Better**, workers work **better** when they see **Quicker**! Light is a production tool. Employ it efficiently, economically by the aid of Permaflexors - the "shaped mirrors" of silvered glass that direct light to where you need and want it

### THE RIGHT LIGHT ON THE WORK FROM 6 OR 60 FEET AWAY

There is a Permaflexor unit for every lighting problem - to provide accurate, controlled light, efficiently - no matter what your mounting requirements may be. Permaflexors are easily, inexpensively installed. Require a minimum of maintenance.



**PITTSBURGH  
REFLECTOR CO.**

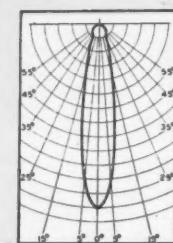
OLIVER BLDG. PITTSBURGH, PA.

Please rush complete data on Permaflexor Industrial Lighting Units. EC-743.

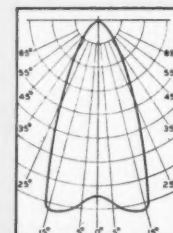
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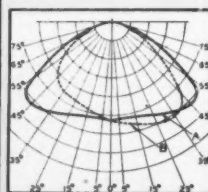
CITY \_\_\_\_\_ STATE \_\_\_\_\_



**CONCENTRATED DISTRIBUTION**  
Permaflexors for high mountings—  
from 25' to 60'.



**MEDIUM DISTRIBUTION**  
Permaflexors for mountings of from 15' to 25'



**BROAD DISTRIBUTION**  
Permaflexors for "horizon" mounting, 15' or less from floor.

### New Literature

[FROM PAGE 98]

ings and oil impregnated hardwood bearings are also featured. Atlas Brass Foundry

### ELECTRICAL EQUIPMENT

**42** Catalog No. 100 illustrates and describes Navy standard and Marine electrical equipment, consisting of wiring devices, lighting fixtures and communication devices. Benjamin Electric Mfg. Company.

### VARNISHED TUBING

**43** A folder featuring Dieflex varnished tubing products including cotton base tubings and sleeveings; varnished tubings standard and magneto grades; Fiberglass varnished tubings and sleeveings. Insulation Manufacturers Corp.

### MOTORS

**44** A 28-page illustrated booklet on American Electrical Standards for Fractional Horsepower Motors. Definitions of all terms and motor parts, speeds and duty classifications, motor types and standards are included in this pocket-sized handbook. The Dumore Company

### Q-FLOOR WIRING MANUAL

**45** A 48-page manual on Q-Floor wiring for under floor electrical distribution in H. H. Robertson cellular steel Q-Floors. It includes listings of accessories and fittings and detailed data on layout and installation procedure. General Electric Co.

### FARM ELECTRICAL EQUIPMENT

**46** Booklet B-3101-1 considers typical applications of small and large portable motors to help farmers meet this year's quota of beef production. It recommends the use of electricity for feed grinding, mixing and storing, electric fencing, yard and barn lighting. Westinghouse Electric & Manufacturing Co.



**LIGHTING SPECIALIST, E. R. D'Olive**, demonstrates the proper type of lighting for power shears at the first War Lighting Conference sponsored by the Chicago Lighting Institute and the local WPB office.

# TO HIT 'EM H-A-R-D-E-R



**T**HE year 1943 promises to be the grimmest, hardest year this country has ever faced. Every effort, and every dollar of national income not absolutely needed for existence, should go into war work and War Bonds.

In the Pay Roll Savings Plan, America finds a potent weapon for the winning of the war—and one of the soundest guarantees of the preservation of the American way of life!

Today about 30,000,000 wage earners, in 175,000 plants, are buying War Bonds at the rate of nearly half a billion dollars a month. *Great as this sum is, it is not enough!* For the more dollars made available now, the fewer the lives laid down on the bloody roads to Berlin and Tokio!

You've undoubtedly got a Pay Roll Savings Plan in your own plant. But how long is it since you last checked up on its progress? *If it now shows only about 10% of the gross payroll going into War Bonds, it needs jacking up!*

This is a *continuing* effort—and it needs *continual* at-

tention and *continual* stimulation to get fullest results.

You can well afford to give this matter your close personal attention! The actual case histories of thousands of plants prove that the successful working out of a Pay Roll Savings Plan gives labor and management a common interest that almost inevitably results in better mutual understanding and better labor relations.

Minor misunderstandings and wage disputes become fewer. Production usually increases, and company spirit soars. And it goes without saying that workers with substantial savings are usually far more satisfied and more dependable.

And one thing more, these War Bonds are not only going to help win the war, they are also going to do much to close the dangerous inflationary gap, and help prevent post-war depression. The time and effort *you* now put in in selling War Bonds and teaching your workers to save, rather than to spend, will be richly repaid many times over—now and when the war is won.

**You've done your bit  Now do your best!**

*This space is a contribution to victory today and sound business tomorrow by* ELECTRICAL CONTRACTING

*Electrical Contracting, July 1943*

101

# EQUIPMENT *News*

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed descriptions, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of **ELECTRICAL CONTRACTING** you saw the item and they will send full details to you.

## Fluorescent Starter

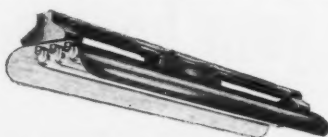
A new glow-type starter, designated as "Glostat" has been added to this line of fluorescent starters. The construction allows it to take severe punishment from a failed lamp. It is available in two sizes. Catalog No. FS-2 is for use with 15 and 20 watt lamps and FS-4 for use with 30 and 40 watt lamps. The "Mirastat", a thermally operated starter, is continued in the line. Sylvania Electric Products, Inc., Salem, Mass.



SYLVANIA FLUORESCENT STARTER

## Fluorescent Fixtures

A new series of Day-Line fluorescent industrial fixtures has been announced. Wiring channel and end boxes which incorporate the socket saddles are of steel, welded together to assure correct lamp spacing and sturdy construction. Non-metallic reflectors and channel covers are finished in baked enamel. Reflectors are held in place by two wing-type latches. Lamp starters are located behind the sockets and are replaceable without disturbing the lamps. Fixtures are listed as single units for two 40, three 40 and two 100 watt lamps and couplings are available for making continuous installations. Daybrite Lighting, Inc., 5411 Bulwer Avenue, St. Louis, Mo.



DAYBRITE FLUORESCENT FIXTURES



SQUARE D MARINE SWITCH

## Marine Switches

A new line of double-throw switches has been added to the present single-throw Type K marine switch. The switches are splashproof and designed to withstand shock tests as specified by the Navy. They are available in 2 or 3 pole, from 30 to 100 amperes, 250 volts a.c., d.c. 575 volts a.c., either fusible or not fusible. The 575 volt a.c. switches have 250 volt fuse spacings. Square D Company, 6060 Rivard Street, Detroit, Mich.

## Test Pliers

Transparent plastic handles and jaws of a new insulated fuse puller house a test circuit which can be used to detect blown fuses or presence of voltage (up to 250) in outlets or along circuits. Hinged prongs, jaws and extension cord test for voltage. It pulls fuses up to 100 amperes. A 10-watt carbon lamp in one handle gives indications that can be seen in any direction and avoids faulty indications often given by a neon glow lamp. Star Fuse Company, 235 Canal Street, New York, N.Y.



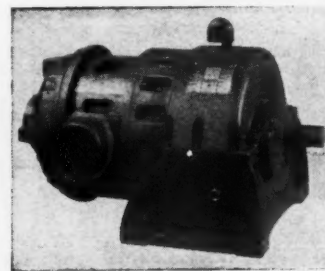
G-E ELECTRONIC METER

## Electronic Meter

A new electronic time-interval meter for measuring short intervals, as low as 100 microseconds, has been announced. The meter is designed for measuring the time interval between two events which can be converted into electrical impulses, such as the elapsed time between the closing of two controls; between two impulses to a phototube; and between an electrical impulse and a light impulse. Consisting of two units—an electronic panel and a phototube with its preamplifier stage—the meter has eight ranges, selected by means of a tap switch so that any time interval of a length between .0001 second and 3 seconds can be measured. The normal input signals consist of changes of light intensity falling on the phototube or the making of external electrical contacts. Operating from a 115-volt, 60 cycle lighting circuit, the meter is stabilized so that normal line voltage variations do not affect its accuracy. General Electric Co., Schenectady, N. Y.

## Gearmotors

A new line of horizontal parallel shaft type gearmotors has been designed for a wide variety of industrial applications over a range of 1 to 75 hp. Adaptor castings between motor and mechanical parts allows use of all standard Westinghouse NEMA frame motors with each type of unit. Gears and pinions in these gearmotors are of .40-.50 carbon steel and are given special heat-treatment before hobbing. Gears and bearings are lubricated by a positive splash system and new case design allows oil to circulate freely. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.



WESTINGHOUSE GEARMOTORS

*Electrical Contracting, July 1943*

To assist in conserving rubber...

## HAZAPAK RUBBERLESS WIRE

- SAVES RUBBER • SAVES TIN
- SAVES CRITICAL SYNTHETICS

**H**AZAPAK Rubberless Building Wire is approved by the Underwriters' Laboratories, Inc., under the provisions of Interim Amendments 44 and 69 of the National Electrical Code.

In this new rubberless building wire, in place of the familiar rubber insulation, there are two separate materials—(1) a thin layer of Kodapak (cellulose acetate butyrate)—a pure insulating material—covering the copper conductor, over which is wrapped—(2) a compacted cushion of crumpled moisture-proofed kraft paper for mechanical protection.

An overall covering of cotton yarn, saturated and color-coated to make it moisture-proof and flame-resistant, provides a finished wire which has the same appearance and diameter as rubber-insulated building wire.

There are two types of Hazapak Rubberless Wire, i.e.: Type EG (Emergency Grounded) and Type EI (Emergency Insulation).

Emergency Grounded Wire, Type EG, is the Underwriters' Laboratories designation for "wire of a type especially approved" in open wiring; in concealed knob and tube work; in non-metallic sheathed cable and as the grounded wire in any of the wiring systems covered by Articles 320 to 364 of the 1940 N.E.C. as provided in Interim Amendment 44. It is used as the white grounded conductor in assemblies such as Hazardex non-metallic sheathed cable and multiple-conductor lead-encased cables. Hazapak Rubberless Wire, Type EG, is always finished white and carries no surface markings. An attached tag indicates that it is to be used only on grounded circuits.

Emergency Insulation Wire, Type EI, as defined in Interim Amendment No. 69 of the 1940 N.E.C., may be used as the ungrounded conductor for non-metallic

sheathed cable run exposed, or for open wiring on insulators, under the following conditions: 1. In dry locations only; 2. For voltages not exceeding 600; 3. If there are more than four conductors larger than No. 10 in an outlet or junction box, or in a cabinet or cutout box, the conductors must be individually wrapped with non-combustible, insulating tape. Type EI conductors should not be used in any hazardous location, except as provided for open work in Section 5075. In damp and wet locations, EI may be used with lead covering, Type EIL, in accordance with Section 3035. Type EI, as distinguished from Type EG, is surface marked and measured every two feet the same as rubber-insulated building

wire. It is produced in standard building wire colors: black, red, green, yellow and blue. Underwriters' Laboratories approval labels marked "Type EI Building Wire" are attached to each coil or reel.

In the move to conserve rubber, the Civil Aeronautics Authority, Spec. 612, authorizes the use of wire such as Hazapak Rubberless for airport wiring, in ducts or for installation directly in the soil; the Federal Works

Agency, Public Buildings Administration in its Suggested Specifications to Architects recommends the use of non-rubber insulated wire like Hazapak Rubberless under certain conditions; and specifications issued by office of Chief of Engineers, War Dept., Construction Div. for Theatre of Operations (Modified) and Mobilization Construction, Section 34 Interior Electrical Works, permit the use of Hazapak Rubberless Wire.

Our sales engineers will be glad to give you further details about Hazapak Rubberless Wire, samples, deliveries, etc., or ask your wholesaler for further information about Hazapak.





# HAZARD



A DIVISION OF THE EXONITE COMPANY

# ...SPERO

## A DEPENDABLE SOURCE For Industrial Electric Fittings and Lighting Equipment

Why waste time and lose orders by "shopping around"? Spero will back you up with prompt deliveries of quality electrical products—priced right. Spero line includes:

### SPERO NOW MAKES NAVY 9S FITTINGS

To meet the demands for 9S Series fittings for the U. S. Navy, Spero now offers a complete line of steel drawn boxes—in 3", 4" and 5" sizes, manufactured according to Navy drawings.

- Fluorescent Lighting Fixtures
- Shallow and Dome Type Reflectors
- Flood Light Fixtures and Equipment
- Vapor-proof Lighting Units
- Surface Cabinets
- Industrial Installation Equipment

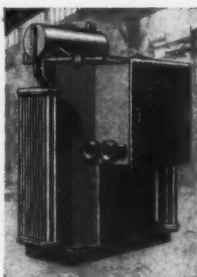
Distributed only through legitimate electrical wholesalers

**THE SPERO ELECTRIC CORPORATION**  
18222 LANKEN AVE. ★ CLEVELAND, OHIO

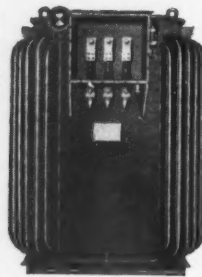
## Uptegraff TRANSFORMERS



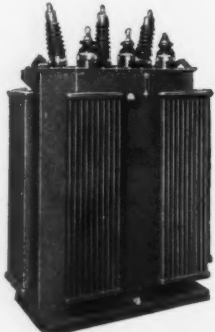
Send for Bulletins of Transformer information and tell us your needs. An engineering staff and a plant devoted entirely to Transformers assures you excellent service and prompt shipment. Write today.



Uptegraff Power Transformer



Uptegraff Power Transformer



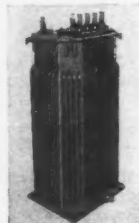
Uptegraff Distribution Transformer



Uptegraff Standard Type Distribution Transformer



Uptegraff Vault Type Distribution Transformer



Uptegraff Standard Type Distribution Transformer

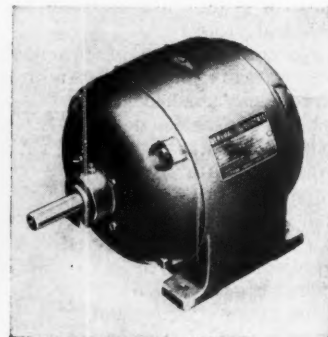
**R.E. UPTEGRAFF Manufacturing Co.**  
SCOTSDALE • • • PENN'A • U.S.A.

EQUIPMENT *News*

[FROM PAGE 102]

### Totally Enclosed Motors

A new line of totally enclosed Tri-Clad motors has been announced. Available in both polyphase, 60 cycle, induction type and single-phase, 60-cycle, capacitor type, they are designed for use under conditions where abrasives, chemicals, rain, snow and excessive dirt are encountered. The polyphase motors are furnished in frame sizes 203 to 225 and include  $\frac{1}{2}$ ,  $\frac{3}{4}$  and 1 hp. at 900 rpm;  $\frac{3}{4}$ , 1, and  $1\frac{1}{2}$  hp. at 1200 rpm; 1,  $1\frac{1}{2}$ , and 2 hp. at 1800 rpm; and  $1\frac{1}{2}$  and 2 hp. at 3600 rpm. The single-phase are furnished in frame sizes 203 and 204 and include  $\frac{1}{2}$  hp. at 1200 rpm; 1 and  $1\frac{1}{2}$  hp. at 1800 rpm; and  $1\frac{1}{2}$  and 2 hp. at 3600 rpm. The mounting dimensions are interchangeable with Tri-Clad open motors of the same rating. These new motors have all the basic features of the Tri-Clad group. General Electric Co., Schenectady, N. Y.



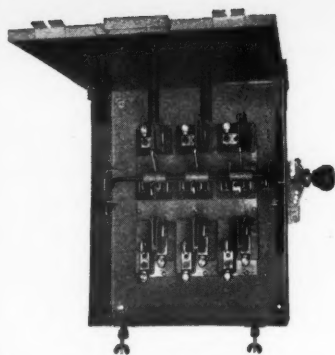
G-E TOTALLY ENCLOSED MOTOR

### Terminal Block

A new multiple terminal block, for sub-panel and chassis construction, with feed through terminals has been developed. It is designed to meet demands of electronic and electrical design, which require external terminals. The terminal block consists of individual feed through terminals, mounted in bakelite, which are held in a metal strip in any combination desired. Terminals have clearances and leakage distances for circuits carrying up to 300 volts, 20 amperes. Center to center distance between terminal units is  $\frac{1}{8}$ -inch No. 8 screws are used on each side of terminal units for securing connection. Curtis Development and Manufacturing Co., 1 N. Crawford Ave., Chicago, Ill.



CURTIS TERMINAL BLOCK



SQUARE D LIGHTING PANEL

### Marine Lighting Panels

A complete line of marine lighting panelboards and power distribution panelboards, designed to meet Government requirements, has been announced. The lighting panel has drip proof top and is built to Naval shock-resisting specifications. Branch circuits have 30 ampere, 250 volt, heavy duty tumbler switches, available in 1, 2 or 3 pole or combinations. Mains can be either 2 or 3 wire, 125/250 volts, a.c.-d.c. It also has the positive pressure fuse clips. Square D Company, 6060 Rivard Street, Detroit, Mich.



G-E PHOTOELECTRIC RELAY

### Photoelectric Relay

A new general purpose photoelectric relay for outdoor use is now available. It is designated as Type CR7505-K108 and is for applications requiring rapid and accurate counting, controlling, sorting or limiting operations. Its contacts control 2 amperes at 115 volts, 25 to 60 cycles, a.c. or 0.5 ampere at 115 volts d.c. In addition to a Type GL-930 phototube, the new relay contains a Type GE-117P7GT pliotron tube. The relay's weatherproof case is equipped with a sun shield and a directional lens system to minimize the effect of slanting sun rays. The unit can be mounted in any position and can be adjusted under operating conditions, without removing the cover. General Electric Company, Schenectady, N. Y.



BullDog's Vacu-Break Safety Switch with "Clampmatic" Contacts provides the faster, tighter closing — and quicker, smoother opening — needed for safest, most dependable operation at lowest maintenance cost.

**ON**

"Clampmatic" switch contacts exert a wedging action when engaged with the beveled ends of the stationary contact prongs. This wedging action puts great pressure on the movable slug, for positive pressure contact in ON position.

**OFF**

When the handle is pushed to OFF position, the static energy stored in clamp spring helps make an easier, smoother separation of contacts. This quick-break operation in the close-fitting arc chamber creates a MAGNETIC BLOW-OUT effect which quickly dissipates arcing.



Streamlined, push type, front-operated rocker handle inside cabinet lines.

### BULLDOG *Vacu-Break* SAFETY SWITCH

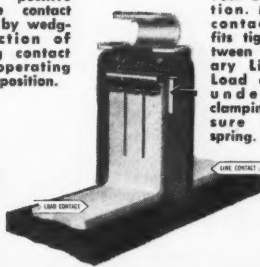
with "Clampmatic" Contacts and front-operated Rocker Handle.

Movement to OFF is speeded by release of static energy in clamping spring.

Formed bakelite cover (arc-chamber) removed from switch head to show action.



Instant, positive pressure contact caused by wedging action of moving contact when operating to ON position.



Full ON position. Moving contact now fits tightly between stationary line and load contacts under full clamping pressure of the spring.

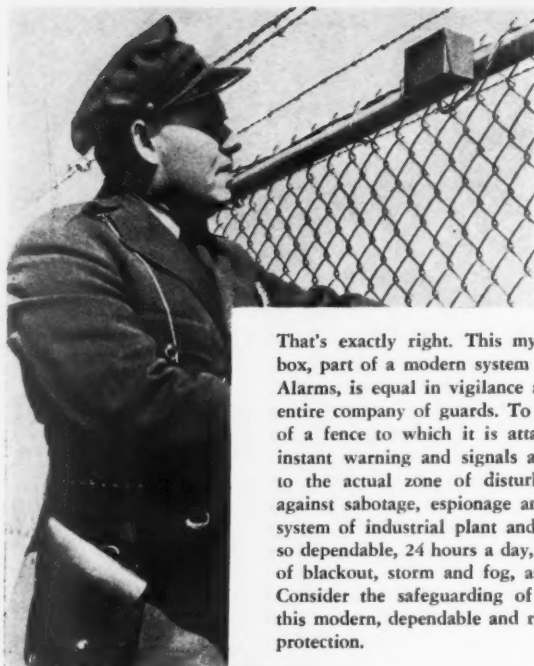
### BULLDOG ELECTRIC PRODUCTS CO.

Detroit, Michigan  
BullDog Electric Products of  
Canada, Ltd., Toronto, Ontario  
Field Engineering Offices  
in All Principal Cities



MANUFACTURERS OF Vacu-Break  
Safety Switches, SaffoFuse Panel-  
boards, Circuit Master Breakers,  
Switchboards, Bus Duct Systems—  
FOR LIGHT AND POWER.

BUY MORE WAR BONDS



## A BOX FULL OF GUARDS

That's exactly right. This mysterious little metal box, part of a modern system of A.A.I. Automatic Alarms, is equal in vigilance and protection to an entire company of guards. To touch it or any part of a fence to which it is attached, is to transmit instant warning and signals and to dispatch help to the actual zone of disturbance. For guarding against sabotage, espionage and theft, there is no system of industrial plant and property protection so dependable, 24 hours a day, even during periods of blackout, storm and fog, as Automatic Alarms. Consider the safeguarding of your industry with this modern, dependable and relatively inexpensive protection.

Write for  
Literature

**AUTOMATIC ALARMS**  
845 MARKET STREET



Licensed under DuPont  
and Atlantic Patents

SALES OFFICES:  
Philadelphia, Chicago,  
Detroit, and Toronto,  
Canada.

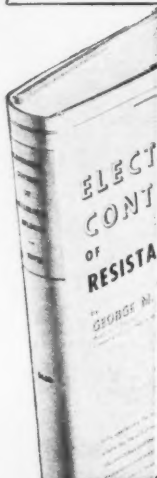
*Incorporated*  
YOUNGSTOWN, OHIO, U. S. A.

### JUST OUT ELECTRONIC CONTROL OF RESISTANCE WELDING

By GEORGE M. CHUTE

Application Engineer, General Electric  
Company, at Detroit

389 pages, 6x9, 173 illustrations,  
\$4.00



#### COVERS

- ignitron contactor
- time-delay relay
- automatic weld timer
- pulsation welding
- sequence controls
- synchronous spot-weld timer
- weld heat control
- seam-welding control
- all-tube control for seam, spot and pulsation welding
- welder controls used with series capacitors
- capacitor stored-energy control
- reactor stored-energy control

Exactly how the electron tubes and other elements of these controls work—

What circuits are used and why—

What happens at every point in the circuit, at each moment of operation—

How to install the equipment—

How to maintain it for long life and efficient service—

—that's the sort of information you can get from this new book by means of some of the most practical, clear, and easy-to-understand explanations you ever have seen applied to a technical subject.

Here is an unusually simple and practical manual, fully explaining the tubes and circuits used to control resistance welders in industrial plants, for the aid of men who work with and maintain these controls. From it, the man with no previous training in electronics can gain a sound knowledge of tubes and circuits and their application in all varieties of control devices, including synchronous timers and stored energy controls. How the tubes work, power requirements, the factors for good welding involved, installation and maintenance of the devices—everything is covered to give the reader the ability to get the most in long life and efficient service from these equipments.

#### 10 DAYS' FREE EXAMINATION—SEND THIS COUPON

McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y.

Send me Chute's Electronic Control of Resistance Welding for 10 days' examination on approval. In 10 days I will send \$4.00, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....

Address .....

City and State..... Company..... EC-7-43

## Calculating Starting Resistors

[FROM PAGE 47]

Assume that it is required to drive a load of 100 lb. ft. torque at 1,000 rpm at the motor shaft. Calculate the required external resistance.

$$\text{By (5), } S = 1 - \frac{1770}{1800} = .0167 \text{ at full load}$$

$$\text{By (2), } T = \frac{50 \times 5252}{1770} = 148.5 \text{ lb. ft.}$$

$$\text{By (3), } K = \frac{148.5}{1.73 \times 260 \times 85} = .00388$$

$$\begin{aligned} \text{By (1), } R &= \frac{.00388 \times 260^2 \times .0167}{148.5} \\ &= .0294 \text{ ohms per phase of rotor winding} \end{aligned}$$

$$\text{By (5), } S = 1 - \frac{1000}{1800} = .445 \text{ at 1000 Rpm}$$

$$\begin{aligned} \text{By (1), } R &= \frac{.00388 \times 260^2 \times .445}{100} \\ &= 1.17 \text{ ohms.} \end{aligned}$$

The external resistance required equals the total resistance minus the rotor resistance or  $1.17 - .0294 = 1.1406$  say 1.14 ohms.

$$\text{By (4), } I = \frac{260 \times .445}{1.73 \times 1.17} = 57.2 \text{ amps.}$$

$$\text{By (6), } P = 57.2^2 \times 1.14 = 3,730 \text{ watts or } 3.73 \text{ kw.}$$

Total power dissipated in three phases  $= 3 \times 3.73 = 11.19 \text{ kw. (15.0 HP dissipated).}$

For this service, a Class 93, 3-phase star connected resistor of 1.14 ohms per phase would be specified on the basis of 85 amps. full load current per phase.

For starting service, the usual requirement is limiting inrush current to some specified percentage of full load current. Suppose that it is required to start the above motor with not more than 150 percent inrush current. Since  $S = 1$  at start, by (4),  $1.50 \times 85 =$

$$\frac{260 \times 1}{1.73 \times R} \text{ from which } R = 1.18 \text{ ohms}$$

and the external resistance per phase would be  $1.18 - .0294 = 1.15$  ohms approximate per phase. On first trial, the resistance so calculated would probably be as much as 20 to 30 percent too great due to the high rotor leakage drop and reduced air gap flux at the start. Additional test starts will indicate the correct value.

Another frequent starting requirement is maximum torque at the start, such as may be required to get a high friction load under way. Here, the total resistance per phase for this duty must be made equal to the locked rotor reactance per phase.

## How to Maintain Electronic Control

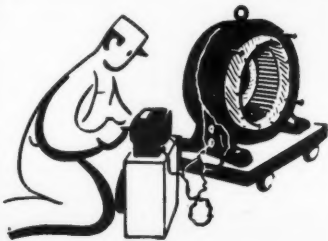
[FROM PAGE 45]

utes. Therefore, loss of operation may be gradual rather than sudden as in the case of power failure. However, small rectifier- and battery-operated tubes cool quickly.

If none of the above symptoms are evident, go carefully through the operation of the circuit and analyze each step. An instruction book for the particular panel or at least an elementary diagram of the circuit should be available. If the circuit is at all extensive, it is usually possible to divide it into two parts, for example, the control and power circuits of a welding control. Then it may be possible to use a meter, electronic voltmeter, cathode ray oscilloscope, or some other means to determine whether or not the control section is operating correctly as the input is varied over the normal range. Likewise, a simulated control signal may be applied to the power circuit to test that half.

Likewise, each part of the circuit can be further subdivided until the faulty circuit or part is found. With a clear knowledge of each part of the circuit, this procedure can be carried out quite rapidly. It is a good idea to check the operation of panels while they are operating correctly and to record voltages found and cathode ray traces seen between specific points. In this way, the differences found in a defective panel will be immediately evident, and the trouble-shooting will take much less time.

If trouble is recurring in certain parts of the circuit, the manufacturer should be notified. Quite often a more permanent solution may be offered or the assistance of the manufacturer's design engineers may be obtained to suggest a cure. Sometimes, slight modifications in the equipment may be proposed to provide more desirable characteristics for the particular installation. In every case, complete information from the panel nameplate as well as a description of the part and the trouble found should be given to the manufacturer so that assistance may be rendered quickly and effectively.



## He needs our help

**OUT** where the fighting is thickest—where communication lines must be strung—in a hurry—he needs pliers and climbers, safety straps and belts, grips and wrenches to get his job done. Taking care of equipment is a contribution toward speeding the day of victory.

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# In the News

## NECA HOLDS WAR CONFERENCE IN CHICAGO

A week-end conference of members of the National Electrical Contractors Association was held in Chicago on Sunday, June 6, with a roster of more than 210 members present. The conference was called for the discussion of immediate adjustments the electrical construction industry can make toward cooperative planning for more effective contributions in the war effort.

The conference tackled four major subjects in an uninterrupted day of business sessions; electrical contractor participation in Maritime and Naval ship-building; opportunities in war plant electrical maintenance; labor-management cooperation for solving industry problems and a preliminary approach to industry postwar planning.

The meeting opened under the chairmanship of President Robert W. McChesney. Commander Kellogg, speaking for Commander John A. Kennedy, chief, Smaller War Plants Section, Office of Procurement and Materials, Navy Department, outlined the procedure for seeking this Navy ship-building work. L. R. Sanford, representing Admiral H. L. Vickery, U. S. Maritime Commission, described many of the special problems inherent in electrical work on ship board under the rules of the Maritime Commission. He emphasized that the services of electrical contractors have proved successful but that under contract procedure, it is essential that the contractor sell his services to the prime contractors.

Joseph D. Keenan, who has recently been named a vice chairman for labor of the War Production Board, urged that electrical maintenance work in war plants be turned over to electrical contractors, since construction programs are being cut.

In a labor-management cooperative session, closing the program, M. H. Hedges reported for a joint NECA-IBEW post-war planning committee. This plan is claimed to be one of the greatest forward steps in the history of the industry.

## CHICAGO HOLDS WARTIME LIGHTING CONFERENCES

The Chicago Lighting Institute and the local War Production Board are working hand in hand to improve the quantity and quality of war material produced in Chicago industries, through the increased use of light. The method employed is a series

of Wartime Lighting Conferences, the first of which was held May 19 at the Institute Headquarters. In opening the session, W. C. Wright, production Coordinator, WPB, Chicago, stressed the value of good lighting and the importance that the War Production Board places on it as a production tool.

Four freedoms of production lighting—freedom from eyestrain, glare, sharp contrasts, and shadows, were outlined by Carl W. Zersen, manager of the Lighting Institute, while discussing the principles of good lighting. The session topic, "Light for Sheet Metal Fabrication" was thoroughly reviewed by E. R. D'Olive, Illuminating Engineer, who discussed and demonstrated the proper lighting necessary for hand and power shears, hand and power brakes and folding machines, punch-forming presses and lay-out tables.

More than 100 representatives of sheet metal fabricators were treated to a novel demonstration of specific lighting solutions to their problems. A unique apparatus

which pictured these conditions in silhouette dramatically showed how proper location of lighting units would eliminate hazardous shadows, contrast and glare.

The data presented at this session was not based solely on textbook theory, but was gleaned from factual information gathered over a period of months by an investigating committee composed of Mr. D'Olive, John Harrington and L. J. Cahill. These illuminating engineers made a tour of Chicago sheet metal industries to observe lighting conditions and make recommendations where warranted.

The results of a second survey were aired at a second conference on May 26, when Ralph Lusk, Illuminating Engineer, discussed with the aid of models, slides and movies, the specific type of lighting needed for welding.

A third session covering lighting for machine tools is scheduled and if interest is maintained, Carl W. Zersen reports that additional meetings will be held.

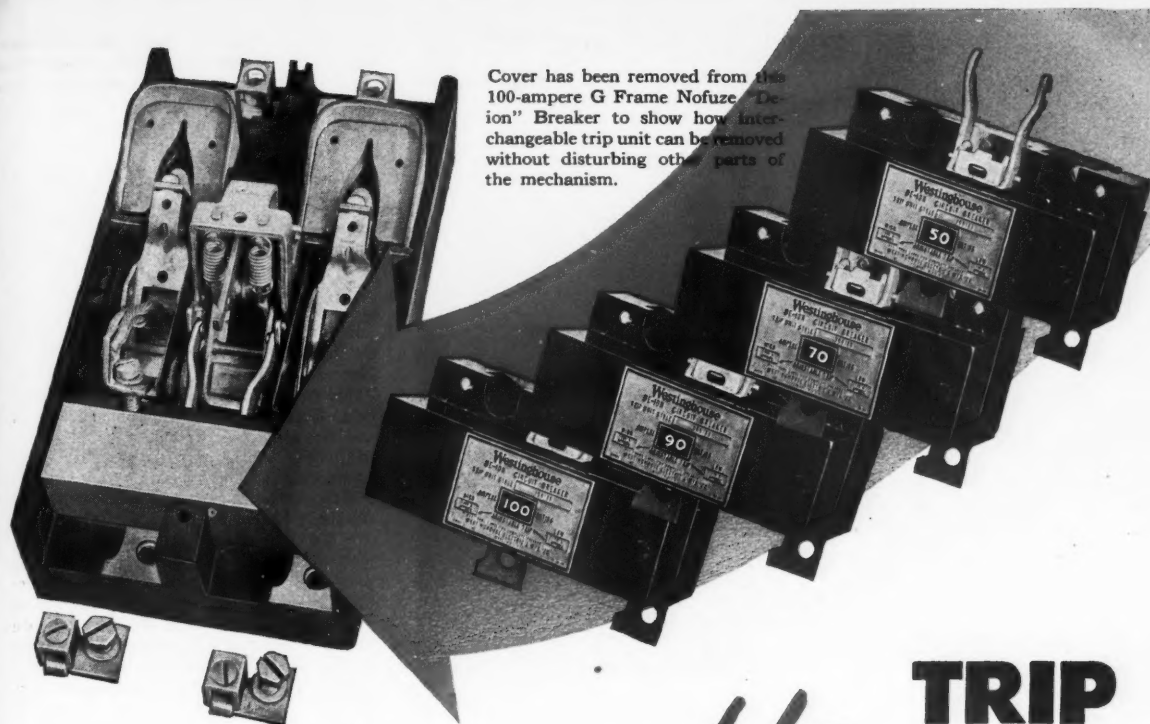
The detailed work of this series of conferences was handled by a special Planning Committee composed of the following specialists in the lighting field: L. V. James, C. B. Harlow, G. K. Hardacre, A. W. Larson, R. G. Raymond, J. L. Stair, E. D. Tillson and C. W. Zersen. Mr. Tillson is the chairman of the Field and Investigating Committees that conduct the surveys.

## INTERPRETATIONS MPR-251

The question has been raised as to whether or not the installation of machin-



"Please use the conduit bender Mrs. Jackson, and stop pretending that's your husband's neck."



Cover has been removed from this 100-ampere G Frame Nofuze "De-ion" Breaker to show how interchangeable trip unit can be removed without disturbing other parts of the mechanism.

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Whether in khaki or "civvies", Nofuze Breakers provide circuit protection that can be accurately fitted to job conditions.

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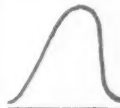
When peace comes, with its equally great problems of conversion to civilian goods, Nofuze Breakers will permit economical and speedy change-overs. For example: In the larger frame sizes, trip units are removable and interchangeable. Thus if your conversion results in heavier or lighter loads, the present trip unit can be quickly replaced with one of the required trip rating. It's as easy as that.

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Prevent harmless overloads from interrupting war production.



Protect circuits from dangerous overloads and "shorts".



Restore service instantly with just a flip of the switch.



# Westinghouse

NOFUZE CIRCUIT PROTECTION

PLANTS IN 25 CITIES... OFFICES EVERYWHERE



[FROM PAGE 108]

ery is included under the Regulation. OPA's answer is "yes", unless the machinery is of the type covered by Regulation No. 136 (Machines and Parts, Machinery Services) and the installation is made by a manufacturer or assembler in which case Reg. No. 136 applies.

Where a contractor has filed a bona fide estimate of material cost (unit price or lump sum sale) under section 1397.57 and, due to totally unforeseen circumstances, his actual material cost is substantially less than his estimate, he need not lower his contract price.

Where a contractor supplies construction and maintenance service to a customer, the customer paying the workmen, material bills, Social Security tax and Workmen's Compensation insurance plus a percentage of cost for the contractors superintending of the work, the contractor is subject to the Regulation as an independent contractor performing a service on a "Cost-plus basis".

Where a landlord makes installations and repairs to his own properties with his own employees and charges his lessees or tenants for such services, he is not subject to Regulation No. 251, or the General Maximum Price Regulation.

Compensation for services which the seller or contractor himself performs is part of the "margin" and not "labor costs". The term "labor costs" refers to expenses actually incurred by the person rendering the service in the payment of wages to laborers and mechanics.

Where a sub-contractor is employed by the prime contractor, the prime contractor is a "purchaser" from the sub-contractor within the meaning of Sections 1397.61 and 1397.62, and must therefore be furnished with the certificate of compliance and the notification required by those sections.



**WE WANT ENGINEERS**, says Col. Charles Keller, District Engineer of the U. S. Engineer Office, Chicago, while delivering a message to the Midwest Power Conference, from Major General E. Reybold, Chief of Engineers, U. S. Army.

## H. B. CROUSE DIES

Huntington B. Crouse, president of the Crouse-Hinds Company since 1897 and a leader in the electrical industry, died on June 12 of a heart ailment in Syracuse. He was 70 years old.

Mr. Crouse, a pioneer in the manufacture of electrical equipment, built up with his associates one of the largest and most important concerns in the country.

Mr. Crouse, a former president of the National Electrical Manufacturers Asso-



HUNTINGTON B. CROUSE

ciation, received the James H. McGraw Award Manufacturers Medal in 1939 for his "long and influential promotion, by both precept and example, of a broader acceptance of the vital importance of consistent policy in company as well as industry affairs." For the past ten years he served as a member of the Committee of Awards of the James H. McGraw Award.

## MPR 20 AMENDED

Two new grades of copper alloy scrap together with maximum prices for each, are established in Amendment No. 1 to Maximum Price Regulation No. 20 (Copper Scrap and Copper Alloy).

The new grades are Tinny Bronze (Phosphor Bronze) Solids with maximum base price of 10½ cents a pound and Zinc Bronze Solids with a maximum base price of 8 cents a pound, both prices are subject to the established deduction for non-metallic impurities.

The Amendment also makes the following additions and changes in the Regulation: 1. A maximum price of 6.04 cents per pound, f.o.b. point of shipment is established for Lead-covered Telephone and Power Cable Scrap. This price applies only to sales of lead-covered telephone and power cable, potheads, splices and butts with or without sleeves which have been scrapped by the Bell System. Previously the maximum price for this scrap had to be determined by the formula provided for pricing Lead-covered Copper Wire and Cable. "The new dollars-and-cents maximum price," OPA said, "does not preclude future settlements for such material on the old basis."

2. Refineries who customarily recover

gold or silver in the treatment of scrap containing precious metals, are authorized in the Amendment to pay a premium for the gold or silver content if the gold content exceeds five-hundredths of a troy ounce per ton, or if the silver content exceeds five troy ounces per ton.

3. The Amendment exempts from price control the charge made for processing copper-bearing material on toll. This frees completely from price control any copper-bearing material sold, delivered or processed on toll. Previously no maximum price governed such sales of copper-bearing material, but the charge for processing the material on toll was subject to the General Maximum Price Regulation. "This control was largely illusory", OPA said, "since whenever the refinery desired and the market permitted, it could obtain the effect of a higher toll charge by abandoning its toll operations and buying the copper-bearing material outright at a relatively low price."

4. To correct an error in the Regulation, Yellow Brass Castings are moved to Group 2 from Group 3 in quantity premium pricing classifications. This means that Yellow Brass Castings are to be considered among Group 2 types of scrap rather than Group 3 when a seller is building up a shipment of 60,000 pounds or more of material to qualify for the ¾ cent a pound quantity premium permitted on such shipments.

## JAMES GALBRAITH RETIRES

When James Galbraith retired as chief electrical inspector for the city of Detroit on July 1, he rounded out more than 45 years of continuous service in the electrical field.

"Jim" first came into contact with the electrical industry in his early teens in Port Huron, Mich., where he started as an electrician's helper for a local contractor. From then on, his career was a steady



**S. N. TIDEMAN**, chief electrical engineer for S. S. Sollitt & Co., Chicago, and formerly in the electrical contracting business, stresses the importance of load and diversity factors in system design at Midwest Power Conference.

Electrical Contracting, July 1943

climb up the ladder until he reached the top. His interest in safety led him to become an electrical inspector in 1905. When 1914 rolled around he was made assistant chief electrical inspector of the city of Detroit, which position he held until he became "chief" in 1938.

During that time he bore the responsibility of keeping one of America's busiest production centers electrically safe—always with a sympathetic appreciation of new and revolutionary techniques; always basing his decisions on considerations of safety. He retired with that rewarding satisfaction of knowing that his job had been well done.

## BOWRY HEADS IAEI

T. W. Bowry, first vice-president of IAEI and inspector in charge of sales control of electrical materials, appliances, etc., for the city of Richmond, Va., was recently elected president of the International Association of Electrical Inspectors. Mr. Bowry, a native of Richmond, was chief electrical inspector for the city from 1924 until 1940.

Other officers elected include: first vice-president, James D. Lynett, New York City; second vice-president, L. P. Dendel, Lansing, Mich.; third vice-president, B. C. Hill, Oakland, Calif.; fourth vice-president, W. R. Volhegy, Portland, Oregon. Victor H. Tousley, Chicago, is the secretary-treasurer of the organization.

## COMING MEETINGS

**International Association of Electrical Inspectors**—Northwestern Section, Seattle, Wash., New Washington Hotel, August 26 and 27. Southwestern Section, Los Angeles, Calif., Mayfair Hotel, Week of August 30. Western Section, Chicago, Ill., LaSalle Hotel, September 13-15. Eastern Section, New York, N. Y., Week of September 20. Southern Section, New Orleans, La., Roosevelt Hotel, September 27-29.

**National Electrical Contractors Ass'n**—Annual Meeting, Hotel Drake, Chicago, Ill., Oct. 10-11.

## COPPER SCRAP PRICE REDUCTION DUE

The War Production Board has announced that as of August 1, 1943, it would terminate its present practice of paying prices substantially above the current scrap price level for copper stocks, unusable in their present forms, which have been made idle as a result of WPB conservation orders and are required for remelting.

The Government will continue to pay the present higher-than-scrap prices, under the copper recovery program, for certain materials reported to the WPB up to and including July 31 and purchased for remelting. These higher-than-scrap prices will not, however, be offered for materials which have been the basis of any claims on the Government for compensation of damages arising out of termination or modi-



## Here is no place for CAMOUFLAGE!

Camouflage should fool the enemy — not confuse the American worker.

Wherever war workers use their eyes, poor illumination is a form of camouflage, obscuring details—increasing the possibility of mistakes—slowing up production. That's

why so many leading concerns have adopted good lighting—Goodrich lighting—as a company policy.

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is important

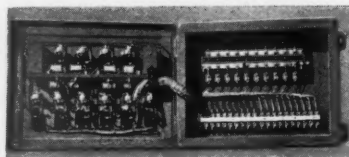
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**Jacksonville Metal  
Manufacturing  
Company**

JACKSONVILLE, FLORIDA

*In the News*

[FROM PAGE 111]

fication of Government contracts. Only reports postmarked before midnight of July 31 will be considered as reported on that date.

Holders of idle inventories of copper and copper-base alloys which cannot be used in their present forms and which are reported on and after August 1 will be directed to sell such materials at scrap prices.

The new procedure, effective August 1, was adopted because of the virtual completion of the change from a peacetime to a wartime economy and because of the general cleaning out of the inventories resulting from that change.

Idle materials which can be used in their present forms will continue to be redistributed, as at present, through direct transactions between owners and purchasers, at negotiated prices.

Under the WPB Copper Recovery Program, purchases for the Government have been made by Copper Recovery Corporation, agent for Metals Reserve Company, a Federal corporation. Forms for reporting idle and excessive inventories of copper and copper-base alloys can be obtained by writing or telegraphing the War Production Board, c/o Copper Recovery Corporation, 200 Madison Avenue, New York City.

#### FARM MACHINERY PROGRAM STEPPED UP

A substantially increased program for the production of farm machinery gets under way July 1.

A total of 300,000 tons of carbon steel, with other materials in proportion has been allocated to the farm machinery program for the quarter beginning July 1. To assure continuous and balanced production, advance authorizations totalling an additional 200,000 tons of steel have also been approved for each of the three quarters from October 1, 1943, to July 1, 1944.

Farm equipment manufacturers are being authorized by telegram to place orders for materials for the new program. The telegrams include allotment numbers under the Controlled Materials Plan which will make it possible for the companies to place authorized orders immediately. Detailed certificates of authorization will follow.

The War Production Board will issue a new farm machinery order to replace L-170, under which the industry has been operating. In order to assure adequate production, distribution, maintenance and repair facilities, the new order will eliminate the concentration features of L-170. It will provide for production of new machinery at approximately 80 percent of the 1940 level.

#### LIST IDLE MATERIAL AND EQUIPMENT

To determine whether a piece of material or equipment should be used in its present form or put into war production in the form of scrap, the Special Projects Salvage Branch of the Salvage Division, WPB, publishes bimonthly, "Available Used Material and Equipment Bulletin."

This publication, providing a ready guide for scrap determination, is distributed to approximately 3,000 government procurement offices and contractors, including the services and other war agencies such as Lend-Lease, Board of Economic Warfare, etc., covering most of



**BRINGING THE WAR** a little closer to home, these members of the armed forces, on leave from the front lines, told snatches of their experiences to the Electric Motor Service Association of Chicago. They are (L to R) Pvt. Orville Volden from Guadalcanal; Capt. Alvin Grauer, Industrial Service Division, War Department and Herb Binner, secretary, EMSA, who arranged the program; Sgt. Bill Hancock, radio-gunner of a Fortress, operating in the Pacific and African theatres; and Pvt. Arthur Provost who saw action on Guadalcanal.

the market for war uses. If any material or equipment listed in this bulletin can be put to use by these agencies, they contact the owner for purchase, and the listing is terminated. If the material or equipment has not been sold within a stipulated period (usually 60 days) after listing, the Regional Office of the War Production Board takes every possible step to move the material as scrap.

One of the most puzzling problems in the national salvage program has been the determination of whether a piece of equipment can be put to immediate war use or whether it should be melted down as scrap. A great deal of equipment is "border-line"; that is, no one can, for certainty, decide if it can be put to use "as is". The owner is usually anxious to have some guide as to the value of his property, and failure on the part of 3,000 war agency purchasers to ask for the equipment is a good indication that it cannot be used in the war effort.

Listing of materials in the "Available Used Materials and Equipment Bulletin" is possible only after investigation by the Regional Office of the WPB and routine reporting of the project has been made. As a direct result of the publication, thousands of tons of metal have been moved as scrap, and thousands of pieces of idle equipment have been bought by agencies for war work.

### MORE ON CONTRACTORS AND IDLE EQUIPMENT

Many contractors who have worked on army camp construction are holding large stocks of equipment in idleness in the expectation of further construction. They fail to realize that the need for new Posts and Stations is practically non-existent and that the holding of construction equipment in idleness in the expectation of future military contracts may be a definite obstruction to other vital wartime projects. WPB officials reported that their Regional Offices constantly receive requests for machines for a wide variety of civilian uses.

### SILVER COMPLIANCE SURVEY

A survey to determine the degree of compliance with wartime regulations on the use of silver is being conducted by about 50 examiners from the Federal Trade Commission acting as War Production Board examiners. They will examine the use of the metal by about 217 companies. The survey is being conducted by WPB's Compliance Division, which stresses the need for strict enforcement of silver conservation order M-199, because of increasing substitution of silver in war production for scarcer materials.

The silver order affects users of both foreign and domestic silver. Foreign silver is defined as any silver except that which has been produced since July 1, 1939, from mines situated inside of the territorial limits of the United States,

## POINTS to Remember about..

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*Lamps*

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- 3 **Champion Economy**—lower light and lamp costs than those of other lamps of equal quality.
- 4 **Champion Distribution**—through qualified local suppliers equipped to meet emergency needs efficiently and intelligently.



Good light and plenty of it has proved a key factor in sustaining both the quality and quantity of American war production. The makers of CHAMPION Fluorescent and Incandescent Lamps are doing their utmost to maintain the supply of lamps worthy of this great responsibility.

Since 1900

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*In the News*

[FROM PAGE 113]

its territories and possessions. For the purpose of the order, domestic scrap, when sold, is considered foreign silver. Domestic silver is all silver other than foreign.

Ceiling price on foreign silver is 45 cents and on domestic 71 cents per fine Troy ounce, with slight variations depending on the form.

M-199 restricts the use of foreign silver in the manufacture of certain items, except to fill war orders; it also limits the use of domestic silver for non-war items to fifty percent of a base period figure.

A few of the uses important for war purposes to which silver has been put are airplane bearings, brazing alloys, electrical contacts, photography, to take the place of copper and tin in plating processes and of copper in the manufacture of fine wires.

#### KNIFE AND ENCLOSED SWITCH ORDER

It has been agreed that the limitation order affecting production of knife and enclosed electric switches should provide for controls over the production of safety switches, enclosed circuit breakers, panelboards, service entrance equipment and knife switches.

A number of suggestions have been made for provisions to be included in the order which would effect a conservation of critical material. Among the sugges-

tions was a proposal to reduce the gauge of the enclosing cases of the devices covered by the order, to stop the use of galvanized steel in their construction and to eliminate doors on certain types of dead-front panelboards.

It has been pointed out that Underwriters' Laboratories, Inc., is wholeheartedly cooperating in the substitution suggestions and is considering relaxing its restrictions to permit such conservation of critical materials as can be affected without impairing the safety of electric switching devices. The proposed order covering the industry will be released in the near future.

#### CONTRACTORS ASKED FOR COPPER SCRAP

WPB's Copper Recovery program has contributed 197,000,000 pounds of idle and excessive copper to the nation's war industries, both in primary and fabricated forms. This amount represents two-thirds of the total amount of copper thus far reported under the program.

Of the remaining 100,000,000 pounds reported, approximately 36,000,000 pounds consist of assembled products contaminated with materials not suitable for copper scrap. Arrangements for the movement of the balance are currently being made at Copper Recovery Corporation.

Because of the ever increasing demands for copper, the program is continuing without interruption. The original estimates of idle and excessive copper to be recovered ranged from 400,000,000 to 500,000,000 pounds. Thus far, 114,000 firms have been approached in connection with the pro-



**AGRICULTURAL STUDENTS** like these boys at the Mayville (N. Y.) Central District School will fight on the agricultural front this summer. Here they receive first hand information on the importance of frequent cleaning and oiling of electric farm equipment from Harry Gilbert, center, Commercial Service Supervisor of the Lakeshore District of Niagara Lockport & Ontario Power Company.

gram and plans are being made to reach 98,000 plumbers, building contractors and their suppliers.

Sales of copper in present form have aided in filling acute shortages and in preventing work stoppages in many war plants, while allocations of copper which cannot be used "as is" to brass mills and ingot makers for remelting have likewise eased many "tight" situations. The Copper Division employs a large staff of experts to facilitate such transactions.

## STEEL RELEASED FOR GUARDS

Steel may be used in the manufacture of guards or housings on mechanical power transmission drives under an amendment to Limitation Order L-193. The original order (Schedule A) prohibited any use of steel in the manufacture of guards or housings used only for protection.

## SILVER REPLACES TIN

It has been estimated by the War Production Board that 3,000 tons of tin will be saved in 1943, and 5,000 in 1944 by the single use of silver-lead instead of tin-lead solder. This large tin saving will result from the use of silver-lead solder in 40 percent of the 1943 output and 70 percent of the 1944 output of cans for foods, household products, chemicals and other purposes.

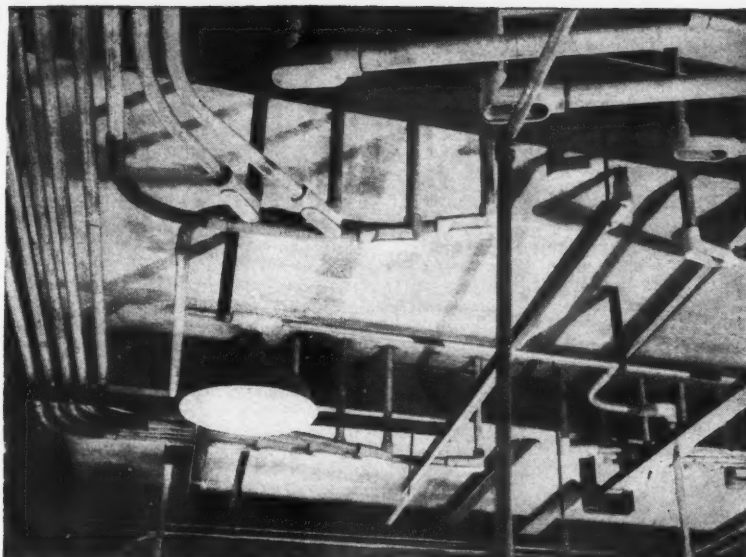
The silver-lead solder contains about 2.5 percent silver, 5 percent tin and 92.5 lead, while the tin-lead solder contains 30 to 40 percent tin and 60 to 70 percent lead. Since lead has almost ceased to be a critical material—all restrictions having recently been removed from its use for essential purposes—the increased consumption of that metal is no problem.

## TIN AND BABBITT ORDER AMENDED

As a result of experience gained in administration of Conservation Order M-43, WPB has amended the order to effect technical changes aimed at correcting certain inequities in the conservation of the nation's supply of tin. In some cases it has been found that necessary uses had been eliminated, and in others that the tin content of material had been too greatly reduced.

Numerous changes have been made in the permitted tin contents in brass and bronze. It has been determined that for the specific purposes outlined, the permitted tin contents are required. It is believed that for almost all other purposes the general restrictions will be suitable.

The use of 38 percent tin solder for wiping lead pipe joints in making connections with outside mains has been permitted because of the pressure at these connections.



# Use G-E Rigid Conduit

## To Protect Wiring in Hazardous or Wet Locations

Two G-E rigid conduits are available to help guard against electrical breakdowns in war production plants. Both are high quality. G-E White is hot-dipped galvanized. G-E Black is coated with a corrosion-resistant enamel.

WPB Limitation Order L-225 permits the following uses for rigid conduit: (Type of protective coating is not restricted.)

1. In war implements such as warships, aircraft armament, tanks, etc.
2. In projects rated A-1-J or better for hazardous or wet locations (with conduit size limitations).

Use these protective conduits for maintenance work . . . for conversion wiring . . . for new war wiring. Also G-E electrical metallic tubing and G-E flexible metal conduit are available for use in certain locations in accordance with WPB Limitation Order L-225.

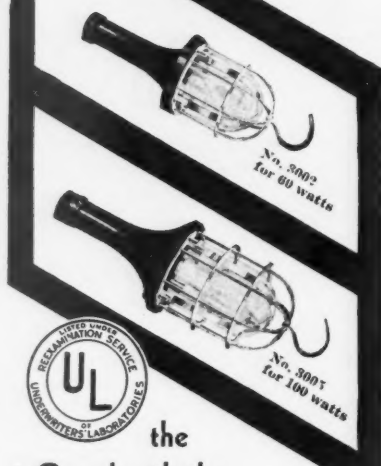
.....

For further information see the nearest G-E Merchandise Distributor or write to Section C731-8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

**GENERAL  ELECTRIC**

## Safeguard

• LIFE  
• PROPERTY  
with MCGILL  
Vaporproof Safety  
Guards



### the Guard with the Seal-Tight Globes

Where there is a possibility of fire, or other disaster from a spark, exposed flame, heat or breaking of bulbs, then McGill Vaporproof Lamp Guards should be used on all portable or extension lights. The tight-sealing globe and heavy cage, with air-tight seal in handle opening, eliminate these hazards at every spot where this guard is used. These Vaporproof guards are designed to stand up under roughest use and abuse.

These guards also protect the light bulb and prevent breakage when used around machines where water and oil might splash on the bulb. Guards also are grounded—an additional safety feature.

ASK FOR LITERATURE

MCGILL MANUFACTURING CO., INC.  
Electrical Division  
Valparaiso, Indiana



## In the News

[FROM PAGE 115]

The exemptions heretofore granted permitting the use of genuine babbitt in the repair and maintenance of mining and quarrying machinery have been withdrawn, since suitable lead base babbitts can now be used.

The use of pure tin coatings on all copper wire .0320-in. nominal diameter and finer and a 12 percent tin alloy coating on thicker copper wire where these coatings are required to meet performance specifications is not permitted. Under certain limited conditions the use of tin and tin alloys for coating steel wire is now permitted.

The unlimited use of tin in the manufacture of fusible alloys and dry pipe valve seat rings is also permitted, since this use is essential to the operation of certain specialized equipment and it is impossible to readily alter the tin contents of the alloys.

The use of a lead alloy containing not more than 2½ percent tin derived from secondary sources for corrosion resisting purposes is also permitted. This has been allowed to facilitate the substitution of lead coatings for zinc galvanizing.

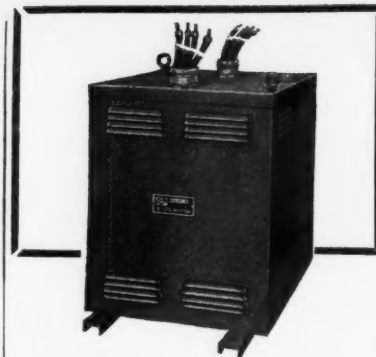
It has recently been brought to the attention of the War Production Board that in some cases customers wishing to purchase material under the various exemption clauses contained in the order have been unwilling to certify to their supplier the specific exemption under which they were making the purchase. Such certifications must be given as it is the only way suppliers can maintain the accuracy of their records. The attention of both purchasers and suppliers is called to the fact that the War Production Board may from time to time investigate the books of any manufacturer or user and that it is of the utmost importance that any such certification be made in order to avoid any misunderstanding between the supplier and the War Production Board.

With the issuance of Order M-43 as amended, Order M-43-a has been formally revoked.

### COPPER SCRAP STILL VITAL

Paul C. Cabot, Director of the WPB Salvage Division, has asked scrap and salvage operators, with facilities to do so, to assume greater responsibility in assisting the Scrap Processors Branch in locating and expediting the movement of critical copper, brass and bronze scrap from trade sources holding small accumulations.

The Scrap Processors Branch representatives supervise all dealer activities and at the present time are endeavoring to assure the 60-day "turn-over" provided for in WPB order M-9-b, which relates to copper scrap. Nevertheless a more aggressive policy must be assumed by large



### AIR-COOLED TRANSFORMERS

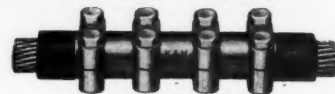
Up To 50 KVA  
Up To 2400 Volts

Acme standard air-cooled transformers are heavy-duty design, built for economical, efficient, continuous performance. Buy quality, specify Acme air-cooled transformers in ratings from 3 KVA to 50 KVA, 3 phase 60 cycle, 240/480; 600; or 2400 volt primary; 1½ to 50 KVA, 60 cycle single phase, 240/480; 600; 2400/4160 volt primary. Write for Bulletin 160.

THE ACME ELECTRIC & MFG. CO.  
36 Water St. Cuba, N. Y.



### STRAIGHT CONNECTOR For Conductors of Equal Size



Catalog Nos. ST500 to ST2000

Designed to resist excessive pull-out strain

### ADJUSTABLE STRAIGHT CONNECTOR No Removable Parts



Catalog Nos. CR4 to CR8

### UNIVERSAL STRAIGHT CONNECTOR Both ends of this Connector are Adjustable



Catalog Nos. O4 to O201

Each end fits over moderate range of conductor sizes.

WRITE FOR BULLETIN 17-A

KRUEGER & HUDEPOHL  
312-B VINE ST. CINCINNATI, OHIO

Electrical Contracting, July 1943



**FATHER AND SON** combination operates Staff Electric Co., Milwaukee, Wis., electrical contractors. John C. Staff, Jr. (left) and his dad are discussing their war plant construction activities. Another son, George K., is also in the organization.

dealers in flushing out copper, brass and bronze scrap from its dormant status into production channels.

In so doing, the expense to the Government of putting a large number of investigators into the field would be eliminated, because sizable operators are in constant touch with smaller concerns and, therefore, could reach them sooner and more efficiently than a less well informed field force.

## CONTROL ENCLOSURES

The prohibition in Order L-250 on the use of enclosing steel cases or cabinets for various kinds of floor mounting type electric controllers has been clarified with respect to the types of cases coming within its jurisdiction.

L-250 prohibits use of the steel cases or cabinets except for use in an atmosphere which is corrosive or which contains metal particles, dust or fumes or for use out of doors without other protection.

According to the Interpretation, electric control cases of the general purpose or semi-dust types are not suitable for protection against corrosion or other atmospheric conditions as stated in L-250. They do not, therefore, come within the exemptions to the prohibition, regardless of the use to which the purchaser alleges he wishes to put them.

## MINES ASSURED COPPER CABLE

The War Production Board has ordered the major cable companies to ship a definite amount of copper cable into their regular warehouses each month. This step was taken to forestall any possible shortages in either emergency or regular production requirements for cable in the mining industry. Results from the order should be evident as soon as shipment can be made to the respective warehouses in June.

# "WAR-AID"

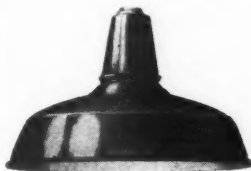
## Fluorescent Fixtures by Wheeler...



Sturdy metal-conserving wiring channel. Non-metallic reflector with chip-proof washable surfaces. Made for 2 or 3 40-watt lamps, or 2 100-watt lamps. Easily adapted for continuous runs.

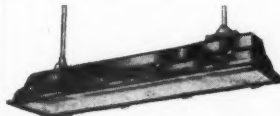
- maintain "skilled lighting" standards
- conserve critical materials

### OTHER WHEELER FIXTURES



**RLM One-Piece Solid Neck Reflectors**

Made in Dome, Angle and all other standard types. For indoor or outdoor use.



**Class II-G Dust-Tight Units**

Fluorescent fixtures approved for "Class II-G" hazardous locations. Hinged cover protects lamps, sockets and reflecting surfaces. Made for two or three 40-watt lamps.

IT takes accurate "seeing" by workers to maintain today's precision standards of production. In any warplant, that means lighting of the most modern, efficient type.

To make such lighting available in spite of wartime metal shortages, Wheeler Reflector Company developed "War-Aid" RLM Fluorescent Fixtures. Made with minimum strategic materials... designed with "know how" gained in over 60 years of specialized experience... "War-Aid" Fixtures offer the same high-efficiency illumination that has always typified Wheeler "Skilled Lighting."

Whether you require fluorescent or incandescent illumination, Wheeler can supply *skilled lighting* for precision production. Write for catalogs of both types. Wheeler Reflector Co., 275 Congress St., Boston, Mass. . . New York, Cleveland. Representatives in principal cities.

Distributed Exclusively Through Electrical Wholesalers

Wheeler

REFLECTOR  
COMPANY

Lighting Equipment Specialists Since 1881



**Hold it,  
MISTER!**

**...there's an easier  
way to end your  
motor problems  
ask Westinghouse!**

Simplify your problem at the start—draft Westinghouse "know-how". With 57 years of Westinghouse motor and control experience at your elbow, you'll find the *one best motor for the job* sooner—with certainty . . . whether it means new design, modification or selection of an existing type. For engineering aid...call or write your nearest Westinghouse office. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

J-21289

**Proof?**

See page 31



**Westinghouse**

**MOTORS**

**AND CONTROLS**

*In the News*

[FROM PAGE 117]

Cables accumulated in warehouses will be available for withdrawal, as the requirements of the mining industry demand, by the mine's certification of its serial number or the certification of a mine serial number by a manufacturer. The cable will be handled through the regular distribution organization of each cable manufacturer.

A list of the warehouses of each manufacturer will be published as soon as received from those upon whom the directive has been served for insulated rubber covered cable.

The first directives cover Nos. 1, 2, 4, and 6 single conductor locomotive cable, same sizes for parallel duplex mining machine cable, and two conductor concentric mining machine cable.

### CARBON BRUSH STANDARDIZATION

A formal program of simplification of carbon brushes used in electric generators and motors was outlined at a meeting of the Carbon Brush Industry Advisory Committee with officials of the War Production Board and other Government agencies in Washington.

The Committee pointed out that the program when completed will be of considerable help to the armed forces in combat areas in overcoming replacement difficulties due to the large number of sizes and types of brushes now in use.

The General Industrial Equipment Division and the Conservation Division, in cooperation with the National Bureau of Standards, have designated Dr. E. W. Ely of the Bureau to work out the details of the program as quickly as possible.

Members of the Committee reported that



**FOUR FREEDOMS** of lighting are—freedom from eyestrain, glare, sharp contrasts and shadows, declares Carl W. Zersen, manager, Chicago Lighting Institute, as he addresses a conference on lighting for sheet metal fabricators.

**HELWIG  
SPEED**

**CARBON  
GRAPHITE  
AND METAL  
GRAPHITE**

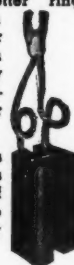
## BRUSHES

for Motors and Generators



● In addition to **MULTIFLEX BRUSHES** for improved commutation, more uniform wear and lower performance costs and **TRANSERT BRUSHES** for even current distribution, better ring lubrication and longer life, we can supply any Carbon product—such as contacts for circuit breakers, etc.

● Write today and let us give you complete details on this line—learn all of the benefits you can realize through our product quality and our specialization.



**HELWIG CO.**  
2548 N. 30TH STREET  
MILWAUKEE, WISCONSIN

*Available Now*

## TIME DELAY RELAYS

*by Paragon*



**Time Delay Relay**  
4 7/8"x3-1/16"x2"

Used to accurately delay the closing or opening of an electrical circuit following a power failure or disconnect of the A. C. operating potential. Or to provide an adjustable time delay between the closing of a pilot circuit and the subsequent closing or opening of the Timer load circuit. Powered by self-starting industrial type synchronous motors.

Hundreds of applications. Each unit precision built—rugged and dependable. Write for complete catalog of time control instruments today.

**PARAGON ELECTRIC COMPANY**  
401 So. Dearborn St., Chicago, Ill.

**Paragon Chicago**

BUILDERS OF ELECTRICAL EQUIPMENT

SINCE 1905

*Electrical Contracting, July 1943*

the increase in aircraft production and the additional demands for replacement material are reflected in the production schedules of carbon brush manufacturers, which call for approximately 82,000,000 brushes and contacts for the electrical equipment required during the third quarter of 1943.

## **Priorities**

### **EXCERPTS FROM L-250 AMENDMENT**

No manufacturer shall accept any order, or commence manufacture in fulfillment of any order, for any controller or part thereof, unless the order bears a preference rating of AA-5 or higher. The restrictions of this paragraph shall not apply to any order for any controllers, or parts thereof, for use on elevators and manufactured by a person engaged primarily in the production of elevators.

All controllers and parts thereof shall be manufactured in compliance with the requirements and shall be otherwise of the simplest practicable design.

Control circuit wiring carrying 15 amperes or less shall have no greater copper content than size No. 14 AWG wire; except when and to the extent that a larger copper conductor is required to avoid abnormal voltage drop or heating.

No control circuit wiring insulation between terminals on a controller shall be of more than one color for each voltage.

No alternating current controller of the reduced voltage autotransformer, reactor, impedance, or primary resistance type shall be provided for a polyphase induction motor of 20 horsepower or less, rated 600 volts or less, except that the limitations shall not apply to a controller for an elevator, hoist or crane.

No controller or control equipment of the types listed, rated 600 volts or less, shall be provided with a floor mounting type steel enclosing case or a floor mounting type steel cabinet, with certain exceptions such as control equipment used below the level of the ground in a mine or quarry; or to any controller to be used in a Class 1, or Class 2 hazardous location as defined in the National Electrical Code.

No stainless steel shall be used in the manufacture of any controller or part; except for resistance wire or ribbon or where necessary to provide non-magnetic properties required for operation or to prevent sticking or binding of moving parts.

### **PRIORITIES REGULATION NO. 3 AMENDED**

Priorities Regulation No. 3 established the uniform method of applying and extending preference ratings. Restrictions on the use of ratings with respect to specific items have been written into the Regulation by an amendment to maintain free distribution of some items, to restrict rated

## **RE-LIGHTING** *the new manpower requirement*

**HERE'S ONE ANSWER  
to this problem...**



*This new folder  
tells the whole story.  
Send for it!*

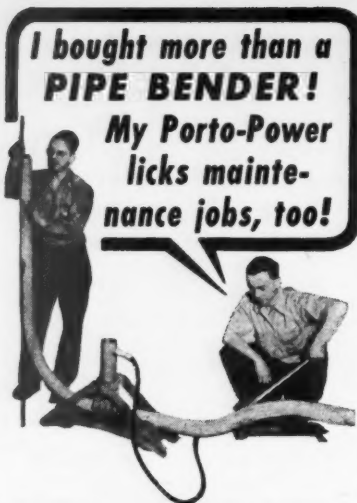
Because most plants operating today were designed for peacetime, *daylight* working schedules, *their lighting equipment is inadequate for night work!*

The folder illustrated gives one answer to industry's problem of *re-lighting*. Silv-A-King's new fluorescent reflectors of non-critical, metal-saving Silv-A-Tex are durable, efficient, inexpensive, and available for prompt delivery. For complete descriptions and specifications of Silv-A-King "Victory" units, write for a copy of "Catalog 43-V" today!



**BRIGHT LIGHT REFLECTOR COMPANY, INC.**  
1033 Metropolitan Avenue, Brooklyn, N. Y.

**BROILKING** AFTER THE WAR, MORE THAN EVER  
America's Finest Electric Table Broiler  
**INTERNATIONAL APPLIANCE CORPORATION**  
1027 Metropolitan Avenue, Brooklyn, N. Y.



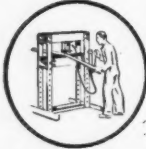
Blackhawk Porto-Power Pipe Benders would still be the choice of many experienced contractors and electricians — even if the Blackhawk Bender could only bend pipe. But, Man! — bending pipe (up to 4"), and doing it well, is only part of the story! Simple attachments can be used with the Porto-Power Hydraulic Unit—to handle tough maintenance jobs, construction work and change-overs. Write for the V-43 catalog or call your Blackhawk Distributor for more details on how Blackhawk Benders can do all this extra work.

**PULL DRIVE PULLEYS AND GEARS** — Smoothly, safely. No crow bars! No sledging!

**LIFT MACHINERY** — Raise a 10-ton load from a low of 3½" to an 8½" height.

**BUILD YOUR OWN PRESS** — Free blueprints! Use the powerful hydraulic unit furnished in the pipe bender.

**A JACK FOR ANY SPAN—ANY ANGLE** — Your Blackhawk power unit is the most refined hydraulic jack available today!



## BLACKHAWK

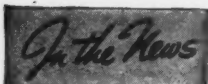
BLACKHAWK MFG. CO.  
Dept. P2073, Milwaukee 1, Wisconsin

Rush your new Hydraulic  
Equipment Bulletin V-43 to us.

Name.....

Company.....

City and State.....



[FROM PAGE 119]

purchases of some items to the production material area, and to prevent use of CMP ratings for the purchase of others.

Ratings applied or extended to any outstanding orders for items appearing on lists A, B, and C which are in violation of the restrictions must be cancelled, according to Interpretation No. 2 of that Regulation.

Preference ratings have no effect on items appearing on List A of the Regulation. WPB desires to maintain a free market for such items. List B items may not be obtained with preference ratings assigned for maintenance, repair and operating supplies. The only preference ratings which may be used to purchase List C items are those assigned by the orders specified following the various items in the list.

### HAND TOOLS TO BE AVAILABLE

Wrenches, pliers, screwdrivers and other mechanics' hand service tools should be more generally available to farmers, home mechanics and other ultimate consumers as a result of an amendment to Order E-6.

The amended order is designed to bring about a better distribution of these tools among consumers and prime procurement programs and to provide for the orderly placement of large contracts within the capacity of the industry and the individual companies.

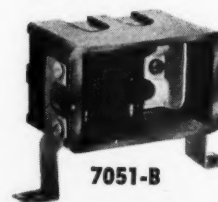
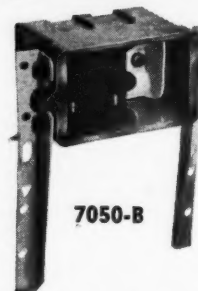
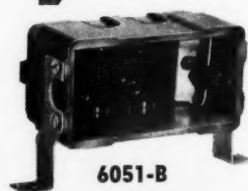
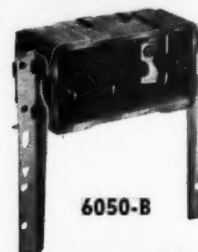
The order now sets aside from 20 percent to 25 percent of the monthly production of specified tools for commercial distributors. According to WPB officials, it will relieve developing tool shortages both in large cities and farm areas.

The 20 percent to 25 percent allocation to distributors is contingent upon the manufacturer having on hand that proportion or orders based upon PD-IX appli-



**PRODUCTION COORDINATOR,**  
W. C. Wright, Chicago Office, WPB,  
opens the first conference on Wartime  
Lighting at the Chicago Lighting In-  
stitute.

## OUR NEW BAKELITE SWITCH and RECEPTACLE BOXES



WRITE FOR CATALOG

**UNION  
INSULATING CO.**  
Factory: Parkersburg, W. Va.  
Sales Office: 27 Park Place  
New York City



**ENTERPRISING LEADERS** of the Minneapolis Electrical Contractors Association, president C. S. Williams (left), and past-president Al Glatty, review post war possibilities in the Twin-Cities area.

cations for priority assistance. If the proportion is smaller, the additional production will be delivered to other buyers, predominately military. On the other hand, distributors will receive additional tools if orders other than PD-IX orders are less than 75 percent of the months output.

The rating required for orders placed on hand tool manufacturers is raised from A-9 to AA-4. Neither retail dealers buying from distributors nor persons buying tools at stores require ratings.

#### FORM PD-200 REPLACED BY WPB-617

Form PD-200, the form used to make application for authority to begin construction and for priority assistance, has been replaced by a new form known as WPB-617.

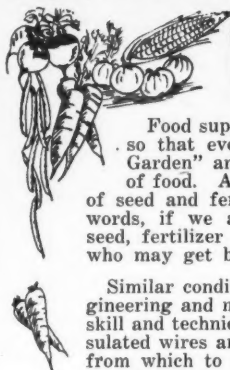
In addition to the functions performed by the old PD-200 forms, the new WPB-617 constitutes an application for allotment of controlled materials. In order to prevent confusion over use of the forms, since all builders were familiar with PD-200, the new form will carry a notation indicating it replaces PD-200.

Beside combining all functions on one form, WPB-617 will have several other advantages. It will be smaller, letter-size, and will fit standard typewriters and files.

Under the Controlled Materials Plan, any person who made application for authority to begin construction and for priority assistance on Form PD-200, and whose application was approved, was required to file additional forms for controlled materials. WPB-617 came into use July 1 and the filing of these additional forms is no longer necessary, since controlled materials will be allotted simultaneously with the granting of authority to begin construction. The authorization form will be CMPL-224, which combines the functions of the P-19 series of orders and forms CMP-4C.

The new WPB-617 has been distributed to all field offices and is now being issued to builders. Prospective applicants are urged to destroy all copies of PD-200 forms and replenish their stocks with WPB-617.

## VICTORY GARDENS AND VICTORY CABLES



Food supply and distribution have become enough of a problem so that everyone who can do so is asked to plant a "Victory Garden" and do a little toward increasing our available supply of food. At the same time, we are warned against wasteful use of seed and fertilizer due to lack of knowledge or skill. In other words, if we are not likely to get reasonable returns from the seed, fertilizer and labor, it is better to leave gardening to those who may get better results.

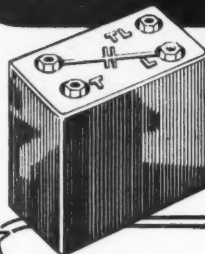
Similar conditions exist in the wire and cable industry. Cable engineering and manufacturing is a task for those with manufacturing skill and technical background. There is need for more and better insulated wires and cables for electrical transmission but the materials from which to make them are limited in quantity and can best be used by those who have the "know how" based on long experience.

Here at Simplex we have devoted nearly sixty years exclusively to the study and manufacture of insulated wires and cables. We have one objective and only one—to make better cables and do it more efficiently. Through study and experience we have developed skill which enables us to make the most of the limited materials now obtainable. Simplex wires and cables—now available only for high priority war work—meet all conservation regulations yet still retain those qualities that assure satisfactory service. Improvements that cannot be disclosed now will make Simplex wires and cables better than ever after the war.

# Simplex WIRES and CABLES

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

## MALLORY CAPACITORS



**Withstand the Punishment  
of Constant  
War Production Service**

When you replace capacitors on any electric motor, you will do well to standardize on **Genuine Mallory Capacitors**. They are built to "take it"—to last longer and give better service.

Remember, too, you can make more replacements with a smaller stock with **Mallory Universal AC Capacitors**; yet the line is complete. It meets all requirements for both round and square types.

Get in touch with one of the offices listed here or write for the **IWI Blue Catalog**.

**INSULATION  
AND WIRES, Inc.**  
2127 Pine Street  
St. Louis, Missouri



**Insulation and Wires, Inc.**  
30 Trowbridge Avenue  
Detroit, Michigan

**Insulation and Wires, Inc.**  
181 Portland Street  
Cambridge, Massachusetts

**Insulation and Wires, Inc.**  
289 Simpson Street, N. W.  
Atlanta, Georgia

**H. A. Holden Company**  
318 Fourth Avenue, South  
Minneapolis, Minnesota

**W. C. Johnson**  
309 Kellogg Avenue  
Peoria, Illinois

**Tri State Supply Company**  
544 South San Pedro  
Los Angeles, California

**Robert McKeown Company**  
249 High Street  
Newark, New Jersey

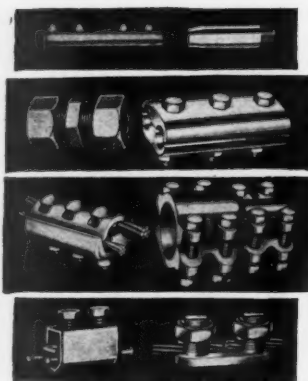
**"It sure is  
HANDY—**

**to have ALL kinds  
in One Catalog!"**



**For any good Straight  
or Parallel Connector,  
see the COMPLETE line**

These illustrations can only suggest the wide variety in the Penn-Union Catalog . . . a complete line of Bolted Straight Connectors and Reducers . . . Screw type . . . Split Sleeve type . . . Shrink fit . . . Universal Parallel Clamps . . . E-Z Connectors that take a wide range of conductor sizes.



Also . . . the most complete line of Service Connectors, Tee Connectors, Cable Taps . . . Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Terminal Lugs.

Penn-Union connectors are the first choice of leading utilities, industrials, electrical manufacturers and contractors—because they have found that "Penn-Union" on a fitting is their best guarantee of Dependability.

**PENN-UNION  
ELECTRIC CORPORATION  
ERIE, PA.** Sold by Leading Jobbers

**PENN-  
UNION**  
Conductor Fittings

*In the News*

[FROM PAGE 121]

### TELEGRAPHIC CERTIFICATION FOR L-192

The certification "in a writing" required under Limitation Order L-192 before a purchaser can obtain construction machinery repair parts to meet an actual or impending breakdown may be made in the form of a telegraphic certification. A telegram is "a writing" and is, therefore, a proper certification for the purposes of L-192, providing it contains the information that the order requires to be set forth in such certification.

If a telegraphic certification is made in such cases where the purchaser is using a preference rating assigned by CMP regulations 5 or 5A or any preference rating order in the "P" or "U" series, that also require certification, the purchaser must further note on his telegraphic certification the sources of his rating and add the statement "ratings certified".

The purchaser also must keep a copy of the telegraphic certification in his records signed by him as provided in Priorities Regulation No. 3.

### ELEVATOR REPAIR PARTS

Restriction on the sale and purchase of maintenance parts of elevator equipment are modified by an amendment to Limitation Order L-89.

The term "elevator" has been redefined to mean any hoisting and lowering mechanism, equipped with a car or platform which moves in guides in a substantially vertical direction; including hydraulic, hydro-electric and hand power elevators, electric dumbwaiters, home-lifts, elevettes; but excluding mine material



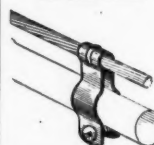
**MEET THE MILLER'S, Henry W. and son Harold of Henry W. Miller Electrical Service, Omaha, Nebraska electrical contractors. Two other sons, Clifford and Norman are also in the organization handling construction work in the field.**



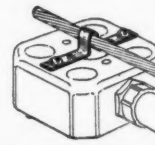
## New Practical Unit to Cut Installation Time

• The "Messenger Hanger" and the "Messenger Strap" fill the need for an economical, practical, time-saving unit for use with the new messenger cable type of installation. Mechanically strong, durable, lightweight. They have considerable material and are easily and quickly installed. Our bulletin gives full and complete details—send for it.

See your Jobber.



"Messenger Hanger" for Conduit and Cable  
Strong, made of Cadmium Plated Steel or Everdur. Top loop of hanger grips messenger cable to permit conduit to be put in place without falling off.



"Messenger Strap" for Outlet Boxes  
Of Cadmium Plated Steel or Everdur. For messenger cable installation to be used with Mineralac "Messenger Hanger". Fits all standard outlet boxes and 1/2" messenger cable.

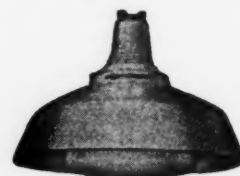
**MINERALAC  
ELECTRIC COMPANY**  
New York City Office 50 CHURCH ST.  
THEODORE S. DALLY  
25 N. Peoria St. Chicago

*Reflectors*  
BY

**MULTI**



INDUSTRIAL REFLECTOR



TWO-PIECE GLASS STEEL DIFFUSER

• Regular inspection . . . regular maintenance . . . the right Reflectors installed in the first place and you have the best that can be had in good industrial lighting. MULTI Reflectors are the right Reflectors to install and then, with inspection at regular intervals you have lighting units approved by user and contractor. Our complete catalog gives data on all MULTI Reflectors—send for it.

**MULTI**  
ELECTRICAL MANUFACTURING CO.  
1840 W. 14th St., CHICAGO, ILL.

Electrical Contracting, July 1943



**TRI-STATE HUDDLE** (finds L to R) B. K. Skeels, Bismark, N. D.; William Tofte, Waverly, Iowa; and C. B. Annis, Minneapolis, Minn., discussing electrical contractors' priority problems at the recent N.C.E.I. War Conference in Minneapolis.

hoists and portable elevators. The term shall also mean inclinators, and electrically operated passenger elevating devices appurtenant to stationary stairways.

The limitations and restrictions do not apply to any order for spare or maintenance parts in an amount which will not increase the parts inventory of the purchaser beyond \$25.00 for each elevator operated by him. Nor do the limitations apply to any order for repair parts in any amount for any elevator when, and only when there has been an actual breakdown or suspension of operations of the elevator because of the necessity for repair, and the essential repair parts are not otherwise available from the purchaser's inventory.

"Maintenance" has been defined to mean the upkeep of an elevator or elevator structure in sound working condition; and "repair" to mean the restoration, without change of design, of any portion of an elevator or elevator structure to sound working conditions, when such portion has been rendered inoperative or unsafe or unfit for service by wear and tear, damage, destruction or failure of parts, or other similar causes.



**DISTRIBUTION SYSTEM** design for industrial plants was discussed by D. L. Beeman, General Electric Co., at the electrical distribution session of the recent Midwest Power Conference in Chicago.



**NO. 770 RIGID CONDUIT AND PIPE BENDER**



**STEEL TUBE BENDER**

Whatever you have to bend—tubing, conduit, pipe, or bus bar—there's a Greenlee Bender to do the job in a jiffy. Shown above is the No. 763 Greenlee steel tube bender for bending 1/4" to 3/4" steel, copper, brass and aluminum tubing. For full details, write for Booklet S-116.

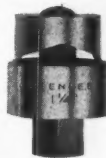
**3 TIMES FASTER**

**with GREENLEE BENDERS**

If you are doing bending work now with obsolete or makeshift equipment, you'll find Greenlee Hydraulic Benders are 3 times faster. One man can operate... smooth, accurate bends are made in a jiffy. There's no wrestling of heavy conduit or equipment... all Greenlee Benders are light, portable, and compactly built. Model No. 770, shown at left, has 25-ton capacity—bends 1 1/4" to 3" pipe or conduit. A 40-ton unit handles 3" to 4 1/2" material. Send for Catalog 33-E.

**KNOCKOUT - TOOLS**

Greenlee knock-out punches and cutters are fast operating, too... are old "stand-bys" for the electrician. They enlarge holes in conduit boxes and cabinets without drilling, reaming, and filing. They are made from high-grade steel, and are properly heat-treated to stand the strain and stress of hard usage. They are, today, saving hundreds of contractors vital hours on war jobs. Write for Catalog 33-E.



**Greenlee TOOL CO.**

1747 Columbia Ave., Rockford, Illinois

# PERFECTION

## Lloyd

STARTERS  
for  
PERFECTION

in Quick Starting  
in Longer Life  
in Service





SPEC. No. 4

Listed and Approved by Underwriters' Labs. Inc., and Canadian Engineering Standards Assoc.

Certified by Electrical Testing Laboratory — Spec. 6.

Certified to Fleur - O - Lier Standards.

Pat. Nos. 2200443—2228210

**LLOYD**

**Products Co.**

Dept. EC-7  
Providence, R. I.

## Safe-T-Glow

HIGH TENSION  
DETECTOR



**S**AFETY RULES call for that EXTRA precaution and additional RE-CHECK which SAFE-T-GLOW provides. Detects accidental tie-ins, crossovers, leakages and induced voltages... prevents serious injury and loss of life. SAFE-T-GLOW consists of a sensitive Neon tube, amplified by mirror reflector.

Model A for circuits 2,000 to 35,000 volts.  
Model B for circuits from 35,000 to 220,000 volts.

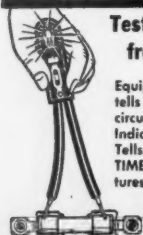
Cut-Out Shows Inside View

Model A 3-ft. handle

Model B 6-ft. added extension

## TEST-O-LITE

Tests Everything Electrical  
from 100 to 550 Volts



Equipped with Neon light which tells instantly where trouble lies in circuits, fuses, cut-outs, motors, etc. Indicates hot or grounded wires. Tells AC from DC. SAVES PRECIOUS TIME. Has PATENTED safety features. Vest pocket size with clip. Lifetime guarantee. List Price \$1.50 at leading jobbers.

**L. S. BRACH Mfg. Corp.**  
55-63 Dickerson St. Newark, N. J.

Need Information on  
**LATEST**  
**AUTOMATIC CONTROL**  
**EQUIPMENT?** YOU'LL FIND THE ANSWER HERE

**ZENITH**

**AUTOMATIC CONTROL EQUIPMENT**

- Stack out Switches
- Transfer Switches
- Remote Control Switches
- Automatic Time Switches
- Automatic Reset Timers
- Magnetic Controllers
- Interval Timers
- Process Timers
- Process Clocks
- Revenue Meters

**ZENITH ELECTRIC COMPANY**  
112 West Madison St. Chicago, Ill.

### Mail Coupon for NEW Catalog

Valuable help to Manufacturers and Contractors. Full information on simplest most dependable equipment. Send Coupon NOW.

**ZENITH ELECTRIC CO.**

155 W. Walton St. Chicago, Ill.

Send me your New Catalog

Just write your name and address in margin. Tear out and mail.



[FROM PAGE 123]

### SMALL SUPPLIERS EXEMPT FROM L-63

Several thousand small wholesale, and retail suppliers which include welding, electrical, industrial, and refrigeration suppliers, have been eliminated from the restrictions of Order L-63 (Supplier's Inventory Limitation).

Henceforth, all suppliers whose total inventory at cost is less than \$35,000 are exempt from provisions of the order.

Officials of the Wholesale and Retail Trade Division said that the order will continue to apply to approximately 20,000 distributors, and that the action was taken after discussion with representatives of the various types of distributors affected by L-63. It had been found that putting the exemption level at \$20,000 subjected many distributors to inventory controls without in any way contributing to an equitable distribution of supplies.

The amended order also eliminates the previous choice of methods for determining permissible inventory. For supplies located in specified states in the western part of the country, inventories are limited to a total dollar value at cost equal to the sales of the same type of supplies during the four preceding calendar months.

For suppliers located in all other states and in the District of Columbia, inventories are limited in total dollar value to the value of sales during the three preceding calendar months, compared to two months previously for distributors in this area.

Other changes made by the amended order are:

1. The amount of inventory which a distributor can carry is determined by the state rather than by the time zone which the distributor is located.
2. Definition of "direct shipments"—which are exempt from the order in determination of sales—is clarified. Such sales include all those in which the goods go directly from the producer to the supplier's customer.
3. The definition of supplies is also restated to make it clear that the specified items covered by L-63 are subject to the order's restriction even though they may be consumers' goods also subject to coverage of Order L-219 (Consumers' Goods Inventory Limitation).
4. Lines of seasonal goods are now permitted to be stocked beyond a distributor's permissible inventory limits during a period not to exceed 120 days.

### AA-5 FOR CIRCUIT BREAKERS

Controls on the manufacture of certain items of electric circuit-breaker equipment have been established by General Conservation Order L-300. Controls are applied to small air circuit breakers of two and three pole power "quick-make, quick-break" types; to breaker attachments, and

To Help You  
Plan and Estimate  
Wiring Installations

## AUSTIN

### OFFERS

OUTLET BOXES  
SWITCH BOXES  
BAR HANGERS  
LINE-O-LETS  
BOX CONNECTORS  
HEAVY WALL CONDUIT FITTINGS  
THIN WALL CONDUIT FITTINGS  
BUSHINGS AND LOCKNUTS  
CONDUIT AND CABLE STRAPS  
R E A FITTINGS  
TOOLS  
LUGS  
NIPPLES  
WIRES AND CABLES  
ARMORED CABLE  
THIN WALL CONDUIT  
HEAVY WALL CONDUIT

These are just some of the items shown in our new 1942 144-page catalog. It is full of useful information and contains hundreds of illustrations that will be most helpful to you. Send for your copy today—ask for Catalog No. CF17.

**THE M. B. AUSTIN COMPANY**  
110 S. DESPLAINES ST. CHICAGO

## ELECTRICAL SPECIALTIES

FOR HEAVY  
INDUSTRIAL SERVICE



One of the many various types of RUSGREEN Endulators. Also End Bolts for use with steel or fibre conduit. O.C. service or non-ferrous metal.

RUSGREEN Bus Supports... made for indoor or outdoor service. All types and constructions.



For more than a quarter of a century, RUSGREEN has specialized in the manufacture of Standard and special electrical items for heavy industrial applications. All are built to the most exacting requirements... assurance that they'll do the job. Write for a complete selection of RUSGREEN bulletins.

ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

★ ★ ★  
**RUSGREEN MFG. CO.**  
14260 Birwood Avenue • Detroit, Mich.

Electrical Contracting, July 1943

to specifications for testing breakers. The order does not affect circuit breakers of the Multi-breaker class.

The new order eliminates the manufacture of electric circuit breakers of certain trip element amperage ratings designated in the order.

It prohibits manufacture of certain attachments to electric circuit breakers designated in the order.

It restricts required testing of electric circuit breakers to tests and calibrations prescribed for circuit breakers in Federal Specifications W-P-131A issued September 26, 1941, or, in cases of high-shock electric breakers, to tests prescribed by Navy Specifications 17B1.

L-300 also provides that on and after June 24, 1943, no purchase order for circuit breakers shall be accepted or delivered unless it bears a preference rating of AA-2 or higher. It is estimated that the conservation measures in L-300 will result in a substantial saving of man hours.

— WITH THE —  
*Manufacturers*

#### Allis-Chalmers Promotions

In a consolidation of an important portion of its electrical engineering and manufacturing operations, Allis-Chalmers Mfg. Co. has made W. S. Edsall manager of a newly combined switchgear and control division of the Company's electrical department. Mr. Edsall comes to his new position in Milwaukee from the Allis-Chalmers Boston works where he has been in charge as manager of the switchgear division.

L. W. Long has been appointed sales engineer in charge of mixed apparatus sales in order to coordinate sales involving the apparatus of more than one division of its electrical department.

Frank C. Angle, manager of the San Francisco district office for the past seven years, has been appointed manager of the entire Pacific region and placed in charge of all sales and engineering facilities serving industries in the Pacific coast area. His territory includes California, Oregon, Washington, Nevada, Utah, Idaho and the western part of Montana and Wyoming.

#### Westinghouse Appointments

Charles A. Conklin has been appointed manager of the Westinghouse Lamp Division's Central District, with headquarters in Pittsburgh. He succeeds Frank C. Barrington, who has retired after 31 years with the company.

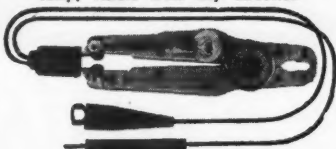
Robert A. Corvey has been named manager of the Southeastern District, with headquarters in Atlanta, succeeding Mr. Conklin at Atlanta.

Gilbert F. Haine, for the past 17 years manager of the Seattle office of the Lamp Division, has been appointed Lamp Divi-

## WHERE TO BUY

### Equipment, Materials and Supplies for Electrical Construction — Maintenance — Repairs

**NEW DESIGN**  
Strong, transparent, plastic carbon test lamp, visible from any direction



**TESTS 110-250 VOLTS**

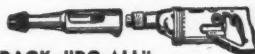
Insulated pliers for testing and pulling fuses. Folding prongs fit base plugs. Test cord attachable.

Can be obtained from G.E.—Westinghouse, or other first class jobbers

**STAR TEST POCKET PLIERS**

235 Canal St. New York, N. Y.

**DRILLS CONCRETE—METAL—WOOD**



**WODACK "DO-ALL"  
ELECTRIC HAMMER AND DRILL**

Saves time and money installing expansion anchors. Drills concrete to 1 3/8" dia.; metal to 3/4". Two tools in one. Easy to maintain. Universal motor. Star drills in 17 diameters. Also chisels, bull points, etc. Write for bulletin.

**Wodack Electric Tool Corporation**  
4628 W. Huron St. Chicago, Ill.

Tel. phone AUstin 9866

## ELECTRICAL CONSERVATION

**MEANS FUSING WITH**

**LITTELFUSES**

3 A G. Underwriters Approved 17 sizes, 1/100 to 8 amps, 250 volts. Wide industrial application. Data available.

**LITTELFUSE INC.** 4789 Ravenswood Ave. Chicago, Ill.



*Whenever*  
**YOU NEED PRODUCTS**

not advertised in a particular issue, write us. This Where to Buy Section supplements other advertising in this issue with these additional announcements of products essential to efficient and economical operation and maintenance. Make a habit of checking this page, each issue.

**ELECTRICAL  
CONTRACTING**

**TORK**



**TURN  
ANYTHING  
ELECTRICAL  
ON & OFF  
REGULARLY**

**The TORK CLOCK CO., Inc.**  
MOUNT VERNON, NEW YORK



**SODERS & FLUXES**

"No Priority"

For Defense or Civilian Use

**L. B. ALLEN CO., INC.**

6715 Bryn Mawr Ave.,

Chicago

**ELECTRIC MOTOR**

**PARTS**

**FOR ALL MAKES**

One of the largest consolidated stocks of motor, fan and controller parts on the east coast.

Write for Catalogue

**READING ELECTRIC CO.**

INCORPORATED

200 William St.

New York City



## “LITTLE BUSINESS” needs Seed Money most of all

### *Every Business needs Friendly Neighbors*

If you want your business to operate in a favorable environment in the post-war world, you must have “friendly neighbors.” That means that people must be conscious of the fact that they are directly affected by your success or failure.

The simple, direct solution to this public relations problem of industry is for each company to use the newspapers of the city in which its plant is located, to create a better understanding of the economic life of that community.

Through these Seed Money advertisements, we are explaining the advantages of the profit-motive to every American. This is being done in newspapers in Washington, New York and Chicago and in our own 22 publications.

But all of the people in every manufacturing center in the United States should be getting these or comparable messages.

We will gladly furnish you a free mat if you want to join the many companies who are doing a basic public relations job by running this Seed Money series in their local newspapers.

*James H. McGraw, Jr.*  
President

McGraw-Hill Publishing Company, Inc.

ONE of the easiest things for you to understand, and one of the hardest things for government to understand is “Little Business.”

Little Business lives right around the corner from you . . . He's the garage man who has pooled his lathe with the lathes of other garage men and opened a factory to turn out war materials . . . He's the machinist who has scraped up some second-hand equipment, hired some other machinists and turned an empty building into a source for bomb-rack parts . . . He's the boat yard owner who has parlayed a little knowledge and a lot of guts into a fleet of subchasers . . . Maybe he is one of the 21,000 sub-contractors who are helping just one large manufacturer (International Harvester Co.) fulfill his war contract.

Everybody knows Little Business because everybody meets businessmen everywhere they go.

Three cheers for Little Business, because—through courage, resourcefulness, and unlimited hours of work, businessmen are helping to win this war.

But, before you join in the cheers, take thought of what we said in the first paragraph: it is hard for government to understand Little Business.

You can do something more effective for Little Business than giving him the empty reward of your applause.

You can help him survive when the war is over.

And don't think it is not VITAL to you that the millions of hustling, adventurous souls who constitute the army of “Little Business” do survive.

The “take a chance” spirit of businessmen is the spark that has made America a great nation.

► Every time a businessman succeeds he makes jobs for other men and women. Every time that happens

**FREE MATS:** If you would like to publish this message over your own company name, or distribute it in handy booklet form, write or wire: Research Dept., McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York (18), N. Y.

## "LITTLE BUSINESS" needs Seed Money most of all (cont'd)

there is more real wealth available for Americans. Multiply that by the millions of Little Businessmen and it's easy to see why it is vital that they survive.

Bear in mind that we haven't said government doesn't want Little Business to survive. Government loves Little Business. All government people get a tender light in their eyes when they speak of the Little Businessman.

But government is handicapped. It wants to help the Little Businessman, but it doesn't know how, because it does not understand the motives and rewards of business adventure.

Business is "profit-minded." That's why it is so hard for government to understand it.

Government should try to understand the profit-motive, because out of profit comes the Seed Money that creates still more jobs. Businessmen lay aside a part of their profits to be used for future development. This is called Seed Money.

Seed Money is not personal profit. It is used to develop new methods and to buy new machines that do more work in less time. These improved machines make higher wages and lower prices possible. In turn, improved machines yield still more Seed Money and the process grows in an ever widening circle. We call the result a "high standard of living."

► With this wonderful, automatic encourager of human endeavor (profit) at its command, wouldn't you think government would say "Swell, here's the device that will make jobs for everybody after the war, pay off the war debt and raise our standard of living still higher. Let's put Seed Money to work harder than ever before."

Does government say this? No, you know it doesn't. Instead, Government regards business profit merely as a source of tax money. It withers progress and improvement for all Americans by draining off the business profits that would create new jobs when the war is over.

Little Business is hit hardest of all.

Generally, a small business has no record of high profits in the years before the war. Therefore, in the eyes of government, most of the profits such a company makes is "Excess Profit" and is taken away in taxes.

What will Little Business do when the war is over? Will he hire his share of returning soldiers, and out-of-work government people, as well as keep the people who are working for him now?

To do that, he will need the best machinery; he must pay for improvement of his products, and finance the distribution and sale of those products.

He'll have the brains and courage for all that, but he won't have the money.

But there are millions of Little Businessmen. They will get together. They and their friends will bombard Congress. Another government bureau will be set up.

► Government money will be loaned. But a funny thing will happen. Little Business will not be free to "take a chance" with this money, because it belongs to the government. But "taking a chance" is the life breath of all business, especially Little Business. There will be a penalty on courage.

You, dear reader, whether you are a bureaucrat, business or professional man, farmer or laborer, can't afford to let that happen to the venturesome business spirit that sustains our national life.

You can do something about it, too. You can help spread the knowledge everywhere that production in war and good living in peace depend upon healthy, constantly improving business and industry. You can be against monopoly and still know that Big Business really exists to serve the millions of men who are Little Business, and depends upon them for its own existence.

You can believe in social reform, and still see that it's one thing to kill the weeds in our Industrial Victory Garden and another to attack the crop.

You can tell your Congressman that the most practical post-war planning he can do is to help in framing laws that will create a favorable environment for business in the post-war world.

*"Industrial Progress  
is the Source of all Good Living."*

### THE MCGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

22 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

#### MCGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

*This advertisement is available in handy booklet form. (Less than 100 copies free. Larger quantities, \$1.00 per 100; \$10.00 per 1000.)*

## McGRAW-HILL

PUBLISHING COMPANY, INC. . . . BOOK COMPANY, INC.

330 WEST 42ND STREET, NEW YORK (18), N. Y.

### THE MCGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

American Machinist • Aviation • Bus Transportation • Business Week • Coal Age • Chemical & Metallurgical Engineering • Construction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets • Engineering News-Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Wholesaler's Salesman • Business Publishers International Corporation, an affiliate, publishers of Business and Technical Magazines for Latin America, and Overseas Circulation.



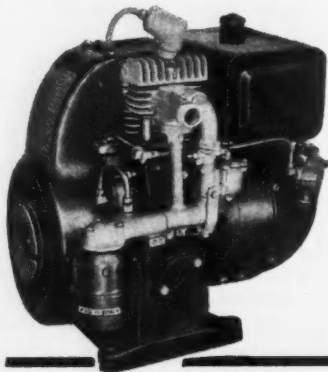
# ONAN

## ELECTRIC PLANTS

### Doing a Winning Job in the War

ONAN GASOLINE DRIVEN ELECTRIC PLANTS provide electricity in any location where it is not otherwise available, and for emergency and standby service.

Thousands of these reliable, sturdy plants are doing a winning job on all the fighting fronts by providing power and light for many vital war tasks.



Ratings from 350 to 35,000 watts. A.C. 50 to 800 cycles, 110 to 660 volts. D.C. 6 to 4000 volts. Also dual A.C. and D.C. output models. Air or water cooled engines.

Details gladly furnished on your present or post-war need for Electric Plants.

**D. W. ONAN & SONS**  
799 ROYALSTON AVE. • MINNEAPOLIS, MINN.

### The Stone You Can Bend and Twist



## Flex-Stone

What a job FLEXSTONE does! Cuts like an abrasive stone—but you can bend, twist it. Won't break! Thin, non-brittle. Sharpest abrasives are pressed into flexible core. Easily fits tight places. Smooths hardest contact points in relays, cutouts — cleans small commutators, switches, etc. Non-conductor — no short circuit. Rimac FLEXSTONE speeds electrical service. Send for free sample!

RINCK-McILWAINE, Inc., 16 Hudson St., New York, N. Y.

### CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY  
330 West 42nd Street, New York, N. Y.

Director of Circulation:

Please change my address on Electrical Contracting

From .....

To .....

Signed .....



[FROM PAGE 125]

sion Manager for the Los Angeles area. He succeeds Bert R. Deleray, who has resigned to accept a position as manager of the San Francisco branch of the Tri-State Supply Corporation.

### Sylvania Changes

Sylvania Electric Products, Inc., Salem, Mass., announces the appointment of Garland Morse as Philadelphia Division manager. He formerly handled fluorescent socket and starter sales for the company and will now coordinate all lighting sales activities in the Philadelphia Division with headquarters in the Lincoln-Liberty Building, corner Broad and Chestnut Streets.

Sylvania Electric Products, Inc., announces the purchase of the manufacturing facilities, including plant and machinery, formerly operated by Electro Metals, Inc. of 2010 East 71st Street, Cleveland, Ohio. The present staff employees will be retained and Sylvania will continue operations at the present site.

### Celanese Expands Organization

Celanese Celluloid Corporation, Plastics Division of Celanese Corporation of America, has expanded its organization as a result of the increased wartime demands for Lumarath plastics. David S. Hopping has been appointed director of sales development and he will be responsible for advertising, publicity, sales promotion and sales training. Miss Harriet E. Raymond continues as advertising manager.

W. Richard Donaldson, formerly with Turck, Hill & Company, has been appointed director of market research. William F. Cullom, formerly a sales representative in several of the company's divisions, has been named director of sales of the Films and Foils Division.

### Star Electric Appointments

The appointment of a new executive staff of the Star Electric Motor Company and its affiliate, the Star Equipment Corporation, both of Bloomfield, N. J., was made recently, due to the death of Carl M. Peterson, co-founder.

Elvin E. Hallander was made first vice president of both concerns, Ivor C. Peterson, vice president in charge of sales and R. J. Gash, secretary and treasurer. Raymond E. Hallander becomes vice president in charge of planning and purchasing for the Motor Company, while Fred Eberhard becomes vice president and general manager of the Equipment Corporation. Elvin E. Hallander is also general manager of the Motor Company.

## SEARCHLIGHT SECTION

(Classified Advertising)

Employment Business

Equipment

(Used or Resale)

"OPPORTUNITIES"

### UNDISPLAYED RATES

15 Cents a Word. Minimum Charge \$3.00. POSITIONS WANTED (full or part time individual salaried employment only), 1/2 the above rates payable in advance.

BOX NUMBERS—Care of publication New York, Chicago or San Francisco offices count as 10 words. DISCOUNT OF 10% if full payment is made in advance for 4 consecutive insertions.

### DISPLAYED RATE

INDIVIDUAL SPACES with border rules for prominent display of advertisements.

The advertising rate is \$7.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request. An ADVERTISING INCH is measured 1/8" vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by July 21st will appear in the August issue, subject to limitations of space available.

### Electrical Engineer Wanted

Midwestern manufacturer seeks junior electrical engineer; graduate with some shop experience for development and research work; 25-35 years of age and with satisfactory draft status; address

P-303, Electrical Contracting  
520 No. Michigan Ave., Chicago, Ill.



**WE BUY & SELL  
MOTORS  
TRANSFORMERS  
MOTOR GEN. SETS  
OIL SWITCHES  
AIR CIRCUIT BREAKERS**

ELECTRIC EQUIPMENT CO.  
578 Lake Ave., Rochester, N.Y.  
Tel. Glenwood 5781

### FOR SALE

### TRANSFORMERS

3-200 K.V.A. Single Phase Westinghouse Transformers 13200 to 2400 Volts, Subtractive Polarity. Complete information upon request.

Enterprise Electric Co. of Md., Inc.  
25 East Lee Street Baltimore, Maryland

# WANTED

### WILL PURCHASE

Any quantity Fractional H-P Motors for CASH

Fractional H-P Motors—Always in Stock

H. U. MANN CO.

540 Lake Shore Drive CHICAGO

### G. E. Appointments

W. A. Mann has been appointed assistant manager, Industrial Division of General Electric's Central District, Chicago.

Frank P. Nemec has been named manager of purchasing division of General Electric Lamp Department at Nela Park, Cleveland. This post was left vacant recently because of the death of Fred P. Harris.

### Schwarze Additions

Recent additions to the personnel of Schwarze Electric Company, Adrian, Mich., include Paul H. Hill as sales manager, formerly with Westinghouse Electric & Mfg. Co.; Charles H. Brown as assistant sales advertising manager and M. I. Bradley as production manager, formerly plant manager of Lycoming Motors Division, Aviation Corp. of America.

IlSCO Copper Tube and Products Co., Mariemont, Ohio, announces the election of Andrew H. Stubbers as president. He has been with the organization for over fifteen years during which he has been active in practically all the departments of the plant. Mr. Stubbers will continue as sales manager.



STUBBERS

The Ridge Tool Company, Elyria, Ohio, has recently moved from its original factory site at North Ridgeville into completely remodeled and modernized plant and offices in the city of Elyria.

Ilg Electric Ventilating Co., 2850 North Crawford Avenue, Chicago, is building a new Research Laboratory, immediately west of the present plant.

### Curtis Lighting Changes

M. C. Wilt, executive vice-president of Curtis Lighting, Inc., Chicago, has been commissioned a Lieutenant Commander in the Supply Corps U.S.N.R. and will be on leave of absence from Curtis for the duration.

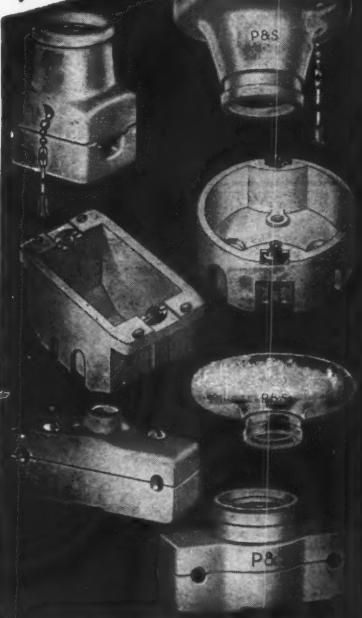


MORROW

G. T. Morrow, vice-president in charge of sales, will assume Mr. Wilt's duties with the title of acting general manager. He will retain his responsibilities as vice-president in charge of sales. He has been with Curtis since 1923.

# P&S

(time-tested)  
**PORCELAIN**  
*Wiring*  
**DEVICES**



Just as P&S PORCELAIN WIRING DEVICES installed years ago are still serving faithfully—so new installations of these devices will serve long after this war is won.

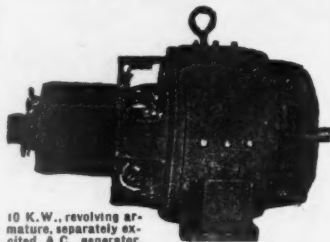
Ask for complete information.

Sold through Electrical Wholesalers

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INCORPORATED  
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ANYTIME, ANYWHERE WITH  
**KATOLIGHT**  
GENERATORS AND POWER PLANTS



10 K.W., revolving armature, separately excited A.C. generator.

Furnish same kind of current as city power lines for operating standard A.C. portable electric tools, transmitters, receivers, floodlights, etc.

Good deliveries on A.C. generators, 350 through 15,000 watts. Available in all standard voltages 110, 220, single phase, 2 or 3 wire, three phase or three phase four wire. Frequencies 25, 30 or 50 cycle on specification.

Kato's entire production at present must be confined to orders with high priorities.

Also manufacturers of a complete line of rotary converters

**KATO ENGINEERING CO.**  
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★ These companies have included Briefalogs, containing additional buying information on their products, in the 1943 edition of the Electrical Buyers' Reference.

*Before*

*After*

THREE 3-POLE  
CIRCUITS AND  
OBSOLETE OPEN  
TYPE MAIN  
SWITCH

TWELVE 3-POLE  
CIRCUITS AND  
PROVISION FOR  
TEN ADDITIONAL  
... SAME BOX,  
SAME CONDUIT

## Here is a timely source of profitable industrial business

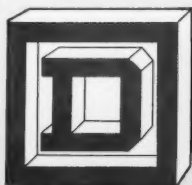
● Increased production has brought the demand for more power distribution in scores of plants. There are countless fusible panels similar to the one shown at the left above— inadequate and subject to excessive heating.

Notice how easy it is to convert to a com-

pact, dead front circuit breaker panel. Notice, too, that by utilizing thin wall wire, additional circuits have been provided, using existing box and conduit.

Why not go after this kind of conversion business? There's a lot of it to be had.

*Square D equipment is distributed by 550 leading electrical wholesalers throughout the country*



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DETROIT

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### G-E LOOM BUS-DROP CABLE

This rugged cable can be hooked up easily from LVD or bus duct systems to machines. Use it on maintenance jobs, re-wiring jobs or new war wiring jobs. It will give long service. It is neat looking and is resistant to oils, grease, gasoline and moisture and is flame retarding.

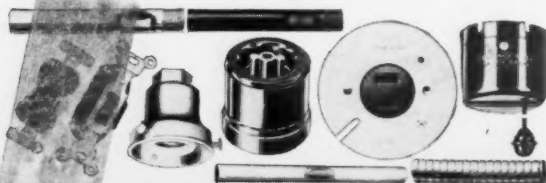


## G-E BUILDING WIRE FOR WAR PURPOSES

This high quality wire is ideal for war jobs. It is easy stripping, clean stripping and easy pulling. You'll like to use G-E Building Wire and your customers will like the dependable service that it gives. Six grades of insulation are available: Type R, Code grade; Type RP, Performance grade; Type RH, Heat Resistant grade; Type RW, Moisture Resistant grade; Type EG, Neutral Conductor; Type SN, Flamenol small diameter synthetic insulated. Lead sheathed wires and cables are also available.

### G-E CONDUITS AND WIRING DEVICES

For your war needs General Electric also offers: G-E White hot-dipped galvanized conduit and G-E Black enamelled conduit, EMT, flexible metal conduit and hundreds of switches, lampholders, outlets, fuses, etc.



For further information on G-E Building Wires and Cables, Conduits, Boxes and Fittings or Wiring Devices see your G-E Merchandise Distributor or write to Section CDW-732-8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC